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ILLUMINATING ENGINEERING SOCIETY

EDITORIAL and advertising offices
1860 Broadway, New York 23, N. Y.

PUBLICATION office 32d Street & Elm Avenue, Baltimore 11, Md.

Founded 1906

ILLUMINATING ENGINEERING: The Journal of the Illuminating Engineering Society. Copyright 1957 by the Illuminating Engineering Society. Published monthly in the United States of America. Entered as second-class matter at the Post Office, Baltimore, Md. Acceptance for mailing at special postage rates provided for in Section 1103 P.L.&R., Act of October 3, 1917. Authorized July 16, 1918. ¶ Subscription $12 per year plus extra postage to all countries to which second-class postage rates do not apply; single copies $1.00. ¶ Address changes must be received at I.E.S. headquarters by the first of the month to be effective with the issue of the next succeeding month.

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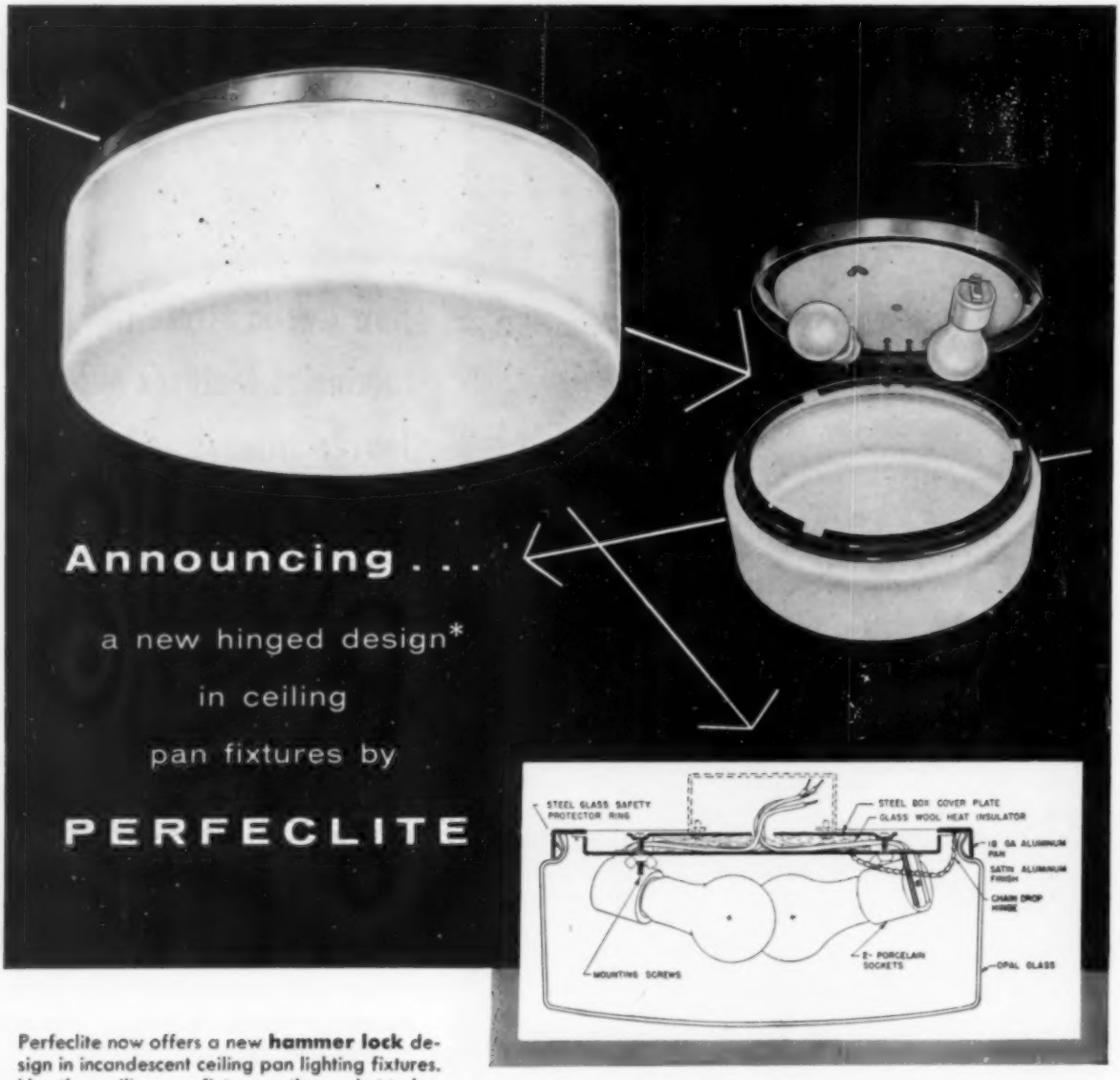

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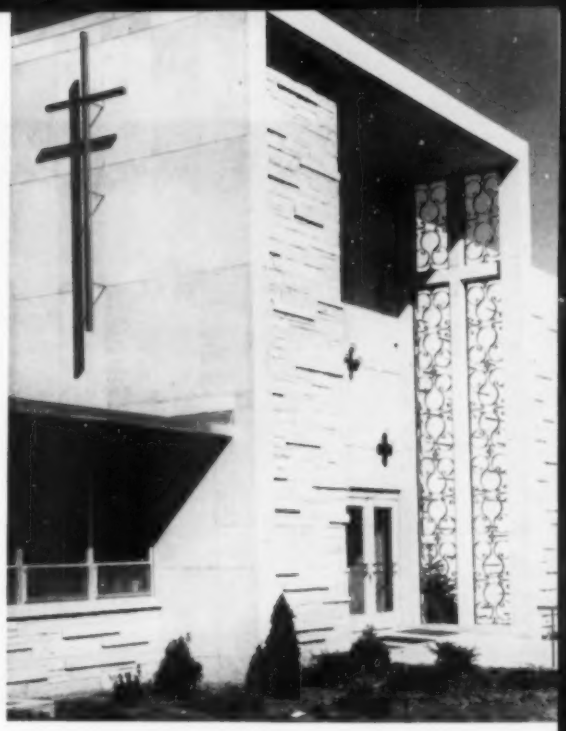
Keeping Pace with Church Building Design

By LOUIS J. RIEGERT



Church lighting problems are discussed with regard to lighting effects rather than engineering and technique. Three main subjects developed are:

- **Period type churches and a comparison of their problems with . . .**
- **Problems of lighting contemporary churches.**
- **Some possibilities for the future.**

QUERY: Is the lighting design for churches keeping up with contemporary church building design? Traditional churches are still being built, of course, but in addition quite different designs are being considered for all denominations — designs which are practical, beautiful and exciting. Lighting for these edifices must enhance the effect; it must be consistent with the design and detail of the architecture. The importance which lighting has in maintaining these effects, even in buildings making quite drastic departure with tradition, has brought more and more architects and engineers to insistence on having complete control of the lighting which goes into their buildings.

As most of us know, there are certain fundamentals which must be considered even before the aesthetics, in church lighting.

1. We must provide an atmosphere which is conducive to worship, and nothing may detract from the ceremony being conducted in the chancel.
2. There must be no glare, and the lighting should be evenly distributed over the pew area.
3. It would be desirable to provide means of dimming and switching, so that a variety of levels may be used for different services.
4. Maintenance should be considered in the lighting plan, from the start.
5. Lighting must help to provide an interesting interior, with good color and brightness balance throughout.
6. The lighting design should fit in well with the architectural surroundings.

One of the most interesting, and certainly a very challenging lighting problem is that for the nave of a church, be it of traditional or contemporary design. Probably no other lighting plan requires more design sense and ingenuity. The problems involved in lighting a traditional church, however, are vastly different from those encountered in a contemporary building. In many of the period churches, we have high loft spaces above the ceiling in which to conceal equipment, for both lighting and maintenance. Below the ceiling we usually have elaborate barrel vaults with deep trusses here and there behind which we have space to hide equipment, and space to relamp this equipment from above.

In the Plymouth Congregational Church, Minneapolis (see photograph), for example, truss work and beams in the ceiling have allowed the designer flexibility in his lighting technique. Here the large luminaires are ornate, and are augmented with smaller units tucked up behind the trusses to provide a general lighting level of the order of 15 footcandles. Usually in large churches it is necessary to use two such types of sources for general lighting in the nave, large decorative units, and smaller units either recessed or concealed from view to provide pew lighting.

AUTHOR: B. M. D. & R. Inc., Minneapolis, Minn.

Elaborate truss work and beams in the ceiling of this church have allowed the designer flexibility in the lighting plan.

In the contemporary church quite different problems are presented. In many modern churches, laminated wood trusses support a plank type roof so that there is no loft space above the ceiling; in effect, the roof is the ceiling. There is no space for recessing; no space for maintenance equipment such as winches or lowering devices. In some of the early buildings, the only solution which occurred to many designers was husks or bullet housings placed in front of the laminated trusses. Some aimed down and some aimed crosswise. The chief disadvantage of this system is difficulty of maintenance because this equipment, especially on the high parts of the truss, has to be serviced with special ladders or scaffolding with the result that many of these lamps, after they burn out, are not replaced. However, it might be possible to design a unit which could be easily maintained with a lamp stick from ladders. As far as the lighting effect of this type of system was concerned, some architects felt that the ceiling in many cases is left dark and unbroken so that a "hay mow" effect is created. The chief culprit is harsh contrasts, bright spots here and there, with not sufficient uplight to relieve the murky condition.

Even yet, many architects refuse to hang "lanterns" in contemporary buildings. Suspended units of this type have had for them some psychological association with the past, when chandeliers were frequently ornate masses of glare hung from the ceiling on chains.

However, many modern interiors have used suspended units with delightful effects (see photographs). This type of design provides adequate light for the pews and at the same time is consistent with the architecture.

Some designers like a clear cut interior without any breakup whatsoever; others want something suspended here and there to relieve the interior. And, of course, the congregation itself frequently prefers a lantern type of design.

Many new developments do meet these demands. While fitting well with the modern interior in their aesthetic effect, they also provide the required illumination. New "tools of lighting" have been employed in them — such as lenses, louvers, efficient reflectors, new developments in light sources — all of which has allowed greater flexibility in their application. New materials have been used in some

Suspended units which have been designed with an eye toward beauty as well as for required illumination.

St. Joseph's Church, Hopkins, Minn. Pew Lighting is provided by recessed downlights in a saw-tooth ceiling. Uplight is from large wall brackets. Maintenance is easy, with catwalks in the loft space for cleaning and relamping the downlights.

—perforated metal and plastics for example. Color has been introduced in others.

Multiple housings, arm-type, lacy units have been used in some modern churches to actually add design beauty to the rather severe interiors. New and different designs with interesting finishes, pierced designs, multiple stems and other variations have also been used to good effect. Many of these units have been designed for their beauty, but are at the same time good lighting devices.

As an adjunct to suspended units, coves have sometimes added up-light to the ceiling with good effect. Care should be taken with coves, however, to avoid bright streaks fading off rapidly. Eerie shadows can result where the light hits purlin or other protrusions on the ceiling.

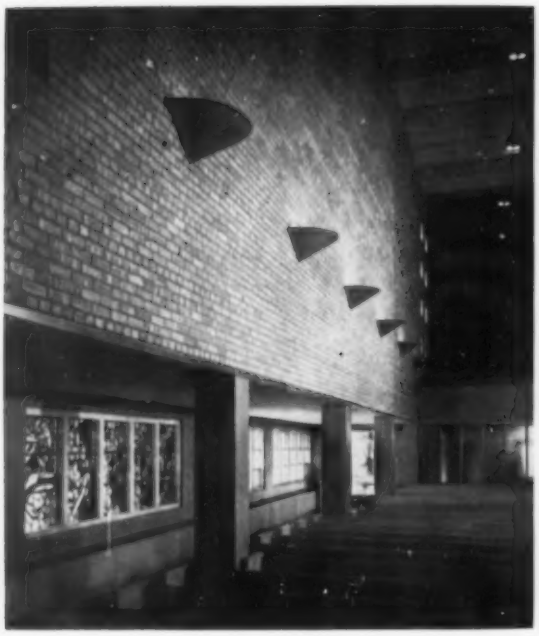
A good dimming system is always worth considering for church lighting for the flexibility it affords to the lighting system. Where a tight budget will not permit the installation of a dimmer, then the switching should be arranged in such a way that a variety of lighting effects can be provided.

Most of the modern church construction so far discussed has assumed a peak type roof design. However, with flat ceilings and where structural conditions permit, indirect systems or a combination direct and indirect can result in good lighting and a pleasing installation. In St. Joseph's Church, Hopkins, Minnesota, shown in the photograph, the pew lighting was provided by recessed downlights in a saw-tooth ceiling. Uplight is from large wall brackets extending out from the wall. In this church, careful consideration was given to maintenance; sufficient loft space above the ceiling permits catwalks used for cleaning and relamping the recessed downlights. These downlights have been recessed into the forward portion of the saw-tooth so that light is thrown forward, and glare is at a minimum in the direction of the congregation.

New and interesting "lanterns" have sometimes been used to add design beauty to the rather severe interior.

Future Possibilities

For church installations in the future, perhaps we can solve some of our wiring problems and at the same time provide even more beautiful aesthetic effects than we have had in the past. Why wouldn't it be possible to use random groupings of nicely designed glass or metal pieces? These could be installed here and there in the church, for a system divorced entirely from our two-row arrange-



Two other simple designs for modern church interiors.

ment which has been used so much. Instead of using coves along the walls to throw bright streaks up to the ceiling, why should we not reverse this, and throw some light down onto the walls to relieve some of this heavy contrast?

Where the ceiling and roof does not permit concealing the wiring, how about using tubing across the truss? Perhaps we could bury the conduit in the side walls and then run a continuous lighting fixture system from which we could either suspend units or attach housings to throw light in whichever direction we would want. We could drop down indirect units to light the ceiling; we could attach direct lighting pieces for the pew lighting; we could mount units for lighting the stations of the cross, as well as provide lighting for the sanctuary, pulpit and lectern. Other variations of this design would be possible with wiring provided in the walls and tubing run up between the trusses to which our lighting could be attached.

With the great variety of shapes of plans and sections in contemporary churches, we should be able to provide some very interesting lighting effects. We are not tied with individual hanging or recessed fixtures to provide the light. Many new shapes of lighting glassware have recently appeared on the market; perhaps we can take advantage of some of these designs, intermingling the glass with pierced metal reflectors, arranging them in interesting patterns, throwing some light up to the ceiling, and providing pew lighting where it is required.

Essentials

Whatever the system, however, we should still provide a minimum of 10 footcandles maintained at the pew level. This lighting should be comfortable, glare-free, and should not detract from the ceremony being conducted in the sanctuary.

We should provide adequate light in the fringe areas such as the balcony, under balcony and side aisles. Luminaire spacing could well follow the rule of thumb: outlet spacing not to exceed the mounting height.

Uplight should be provided to avoid hard contrasts, and to accentuate the loftiness of the church.

We should use a lighting system which can be reasonably maintained.

Lighting designs should be consistent with the architectural design; imagination should be used in developing new lighting effects and systems.

Flexibility should be provided by means of dimmer or proper switching.

Circuits For Fluorescent Lamp Ballasts

By W. W. BROOKS

EIGHTEEN years of practical fluorescent lighting has resulted in the use or description of several hundred different electrical circuits. The new circuits have been created even though the fluorescent lamp has the same basic operating characteristics and ballasting requirements as such old electrical discharge devices as the carbon-arc lamp. Constant development and innovation in fluorescent lighting has moved ahead without a systematic tabulation of all these electrical circuits. This paper has been written to service that need. It is hoped that it will indicate new and unexplored areas to the circuit designer, provide a ready reference for the ballast designer, and supply source material to the sales and service engineer.

Reason for Fluorescent Lamp Ballasts

The fluorescent lamp has the same characteristics as the carbon-arc lamp, *i.e.*, as current increases the decrease in terminal voltage results in a further increase in lamp current which causes a further reduction in terminal voltage. This process will continue until the lamp is destroyed unless the current is limited by an external circuit element. Thus, the external current limiting element, a ballast,[1] is absolutely necessary. Fig. 1 shows the basic circuit for the operation of a fluorescent lamp. The ballasting element to be used is determined by the power supply, the lamp and the type of operation desired. The following is a description of the various ballasting elements and circuits that may be selected for a fluorescent lighting system. For the readers' convenience, references in the patent literature have been cited.

Resistance Ballasting Circuits

The simplest ballasting device for fluorescent lamps is a resistor. The resistor may be either an ordinary resistor or an incandescent lamp which will supply some additional light. Two applications of the resistance ballast are:

(a) Multiple or series operation of fluorescent lamps from a direct current power source.

(b) Multiple or series operation of fluorescent lamps from an alternating current power source where efficiency is less important than initial cost.

It is normal practice on the part of the lamp manufacturers to select a direct current voltage which is sufficiently high that lamp current will not vary more than plus or minus 20 per cent as line voltage varies plus or minus 10 per cent. Because a supply voltage selected on this basis is too low to start the lamp, a starting switch is necessary. The purpose of the starter switch is to allow cathode preheating current to flow and when the switch is opened, to allow voltage to appear at the terminals of the lamp to start it. In order to insure satisfactory starting under all conditions an inductive component (a ballast) is frequently introduced into the circuit to insure that the starting voltage is adequate when the switch opens. The circuit in Fig. 2 was developed for this application. In order to suppress radio interference voltage generated by the lamp a .006 microfarad capacitor was connected in parallel with the lamp.

Fig. 2 shows a further modification of this type of circuit which is desirable because direct current causes a gradual migration of the mercury toward one end of the lamp. It has been the practice to use a polarity reversing switch in circuits for the operation of 30-watt lamps and larger in order to avoid the darkening at the end of the lamp caused by the absence of mercury. In some applications it has been desirable to operate two lamps in series where the direct circuit voltage supply was adequate as shown in the circuit[2,3,4] in Fig. 3.

All the circuits which have been described include starting switches which are manually operated. However, it is often desirable to use automatic starter switches in the circuits for the operation of larger lamps because they may be installed where it is inconvenient to operate the switch manually. Fig. 4 shows the circuit which opens automatically when the thermal element in the switch has heated sufficiently.

The lighting in subway cars, trolley coaches and the like is a good application for slimline lamps.

AUTHOR: Consulting Engineer, Ballast Dept., General Electric Co., Danville, Illinois.

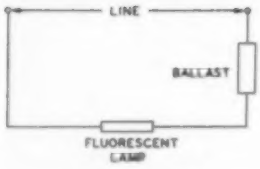


Figure 1.

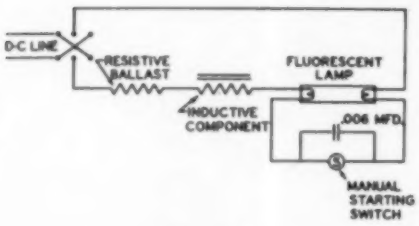
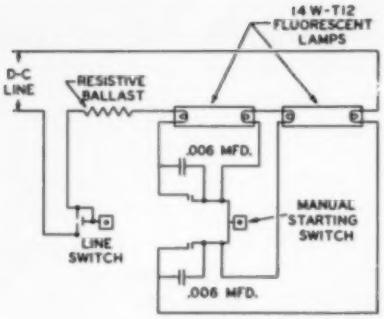


Figure 2.



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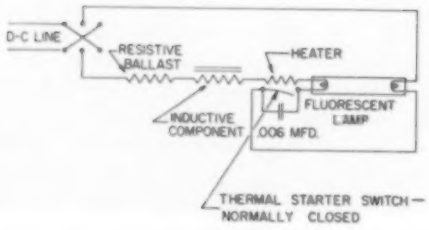


Figure 4.

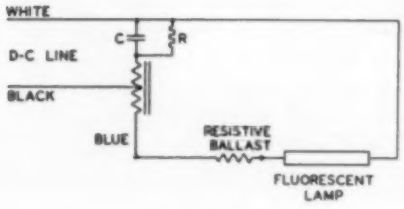


Figure 5.

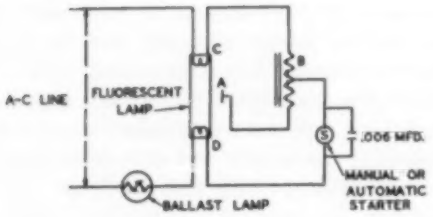


Figure 6.

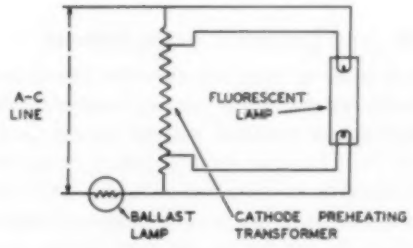


Figure 7.

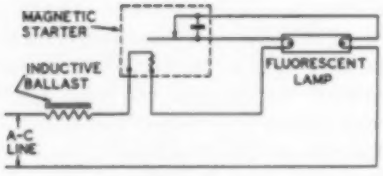


Figure 8.

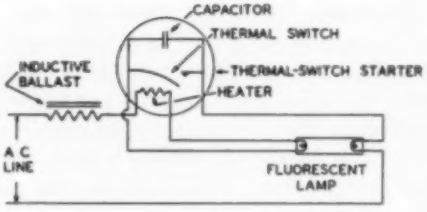


Figure 9.

This created a need to start and operate these lamps from a direct current power supply. In response to this need, circuits were developed with which an instant-start fluorescent lamp can be started in a resistance ballasted circuit. However, because the cathodes of the instant-start lamp are shorted, it is necessary to supply sufficient starting voltage without the benefit of both cathode preheat and the surge voltage generated by switch-start action. One circuit[5] used is shown in Fig. 5. By means of this circuit, a high transient voltage is generated by the autotransformer in that portion of the winding between the black and blue leads. After the transient condition has subsided, no current flows into the primary of the autotransformer, and therefore, no voltage is generated in the secondary.

The other basic application for resistance ballast-

ing is a result of the power supply being alternating-current and the initial cost of the system being more important than efficiency. Fig. 6 shows the circuit[6,7,8] for this system. In this system, the resistance ballast is an incandescent lamp which decreases the dependence of lamp current upon line voltage.

Another special circuit in this category is designed to preheat the lamp cathodes with a special transformer. The line voltage is adequate to start the lamp after the cathodes have been preheated; therefore, no starting switch is necessary. The circuit shown in Fig. 7 is not often used, but it is similar to the more popular trigger-start circuit which will be described later. It has the advantage of higher ballast lamp efficiency as compared to circuits like the one shown in Fig. 6. However, this does not apply in the case of short lamps such as the 14-watt. In such circuits the ballast lamp must be designed to withstand full line voltage during starting. Consequently, the ballast lamp must operate at less voltage and lower efficiency after the fluorescent lamp starts.

Switch-Start Ballast Circuits

Starter-Switches

The success of the switch-start circuit depended upon the development of satisfactory starter-switches. Therefore, their development was an important part of circuitry development and will be discussed.

The manual starter-switch is nothing more than a quick-acting contact-making device which closes the cathode circuit allowing current to flow through the cathodes heating them to emission temperature, and making it possible for a person to release the switch quickly, thereby causing high voltage to appear between the cathodes of the lamp.

Because it was desirable automatically to complete operation of cathode-opening and circuit closing, work continued on the development of starter switches. One starter which is the result of this work is the magnetic starter-switch. In this starter either cathode preheat current or operating current of the lamp flows in the operating coil. Therefore, when voltage is applied to the entire circuit, preheating current flows in the operating coil generating sufficient magnetic pull to open the preheating circuit and impress a voltage surge on the lamp. If the lamp does not start, the sequence repeats until the lamp does start. Then the switch remains open due to the magnetic pull caused by lamp current flowing in the operating coil. This arrangement is shown in Fig. 8. Although this device did start lamps, it could cause damage to the lamp cathodes. For that reason, the search for a satisfactory starter continued.

The successor to the magnetic starter, the thermal starter,[9] came into wide use because it provided reasonable preheating current and satisfactory lamp life. It reached a peak of popularity in the early 1940's and is still used for special applications, such as low temperature lighting. However, it does have a serious limitation. For instance, if fluorescent lamps (in combination with thermal starters) are turned off and then quickly switched back on, there will be a considerable time lapse before the lamps actually come back on. However, the thermal starter does provide, (a) an adequate preheating time, (b) high starting voltage, and (c) considerable independence as far as line voltage variation is concerned. The connection diagram of a typical thermal starter is shown in Fig. 9.

The search for a better automatic starter finally resulted in the development of the glow-starter which might be called the "fair-haired" starter, because it has a short recycling time and reasonably positive starting characteristics. As a result, it has won and held wide acceptance. Fig. 10 shows the schematic diagram of this starter.

In addition to the above group of starters, several others were developed for the purpose of converting switch-start lighting systems to instant-start operation. None of them was used generally because they proved to be uneconomical. Fig. 11 shows the connection diagram of one of them, the Jack-Rabbit starter and Fig. 12 shows the connec-

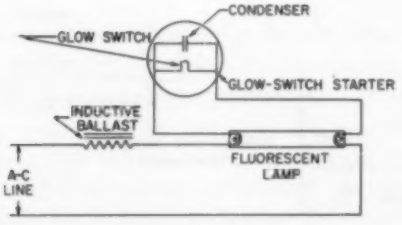


Figure 10.

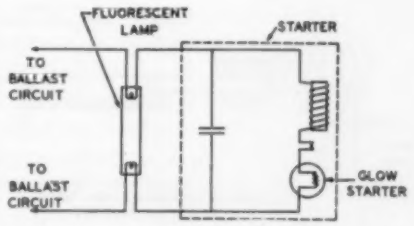
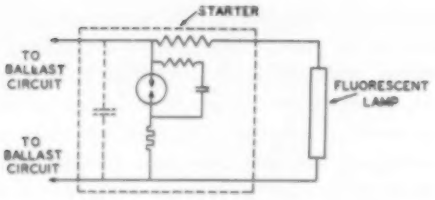


Figure 11.



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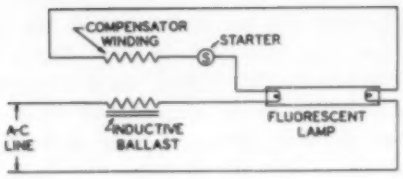
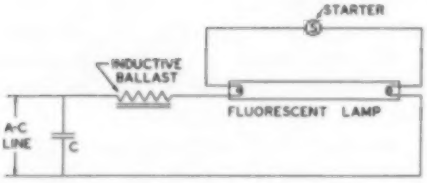


Figure 13.



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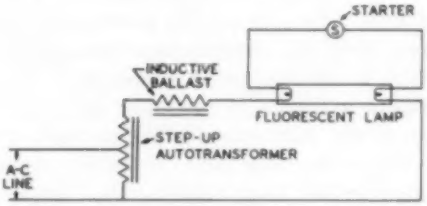

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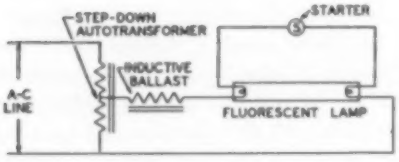

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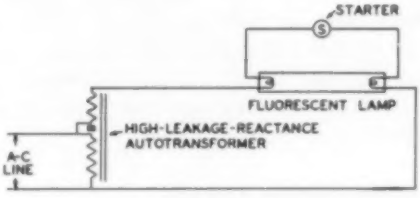

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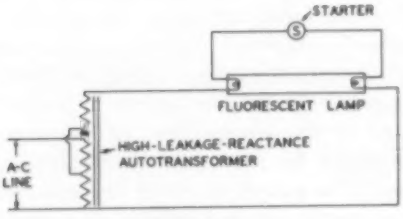

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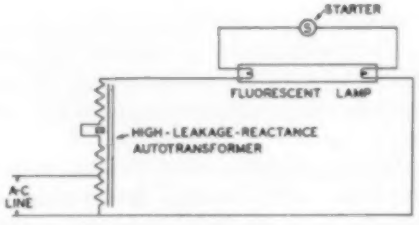

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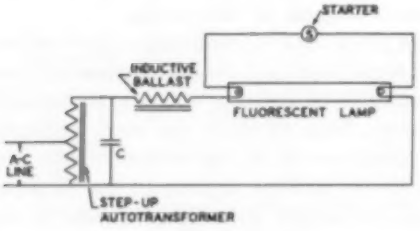

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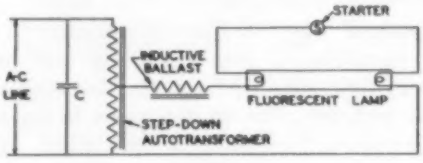

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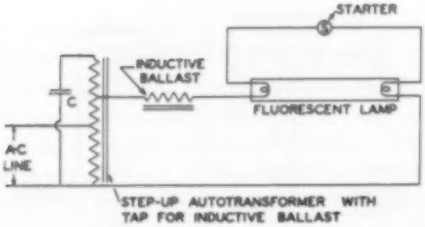


Figure 22.

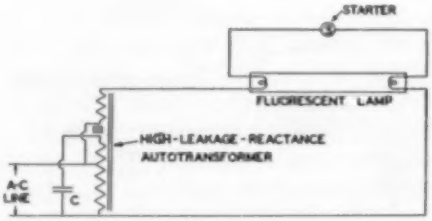


Figure 23.

tion diagram of another, the Glow Oscillator starter.

Low Power Factor Inductive Ballast Circuits

For increased efficiency of these circuits, alternating current must be used as the power source. As a result, an alternating current reactor is the element identified as the ballast in Fig. 1.

The main advantage of this circuit is that the lamp operates more efficiently than when it is resistance ballasted. Also, there is adequate starting voltage if the starting switch operates when the instantaneous current is substantially greater than 0. Finally, reasonable lamp current regulation results when the line voltage is approximately twice lamp voltage.

For fluorescent lamps which are started and operated directly from an alternating current supply with the use of a simple ballasting reactor, the circuit in Fig. 1 is used. However, the ballast is then an inductive ballast. By connecting two inductive circuits in one ballast case, a two-lamp ballast is obtained. Obviously, this idea may be extended further to include as many ballast circuits in one case as is economically practical.

In circuits where the lamp impedance is very low relative to the ballast impedance, it is necessary to provide means of increasing preheat current. This has been accomplished as shown in Fig. 13. In this circuit the starting current is increased by connecting a compensator winding in the starting circuit which has substantive polarity. Therefore, the net impedance of the two windings connected in series is less than the impedance of the main ballasting winding alone, and as a result, the preheating current is greater than the normal lamp operating current.

High Power Factor Inductive Ballast Circuits

The ballast circuits described thus far are all low power factor. To improve the utilization of the utility's power system, it is desirable to provide high power factor ballasts. This has been accomplished in inductive circuits by incorporating capacitors as shown in Fig. 14.

Low Power Factor Inductive Ballast Plus Autotransformer Circuits

The next step in the increasing complexity of ballast circuits was the inclusion of a transformer to step-up line voltage to the open-circuit voltage required for such lamps as 30-watt, 40-watt, 13-watt T-5, 32-watt, and so forth. The connection diagram for this type of circuit is shown in Fig. 15. A similar type of circuit is used when the line voltage is greater than required for the lamp. Fig. 16 shows this connection diagram.

By combining the functions of the step-up winding and inductor into one winding, a considerable reduction in material has been effected. This combination is shown in Fig. 17 for the step-up arrangement. The step-down arrangement is shown in Fig. 18. Actually, these two circuits have been used for the operation of fluorescent lamps from the very beginning of fluorescent lighting systems. They are known as high-leakage-reactance ballasts. Another useful form of this type of circuit is shown in Fig. 19. It enables the ballast designer to increase the open circuit voltage of a high-leakage-reactance ballast without materially increasing the current limiting property of the ballast. The reason for this is that the additional step-up winding is concentrically wound with the primary winding causing it to be very tightly coupled. Therefore, voltage is introduced into the lamp circuit without adding more than a few per cent of current-limiting reactance.

High Power Factor Inductive Ballast Plus Autotransformer Circuits

As with inductive ballasts, the same benefit to electrical utilities results when this type of ballast circuit is power factor corrected. Consequently, circuits are derived as shown in Figs. 20 and 21. It is very interesting that Fig. 22 shows an autotransformer arrangement which enables the use of a capacitor which is moderately high voltage and low capacity to result in a lower cost power factor correction arrangement even though the cost of the autotransformer is increased. The same type of power factor correction has been applied to high-leakage-reactance autotransformer circuits as shown in Fig. 23.

Low Power Factor Inductive-Capacitive Ballast Circuits

Another widely used circuit[10,11] consists of the combination of inductive and capacitive elements which combination is net capacitive. If the inductive and capacitive elements are chosen correctly the lamp current will be of satisfactory wave form and will lead the supply voltage. Fig. 24 shows such a circuit. One of the virtues of this circuit is that it may be combined with an inductive ballast circuit to reflect high power factor load to the power supply. Another feature of this circuit is that it tends to be more constant current in nature than the inductive ballast circuit.

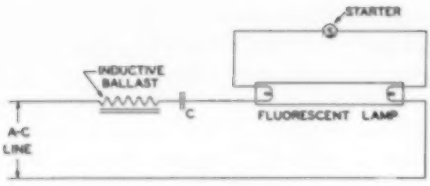


Figure 24.

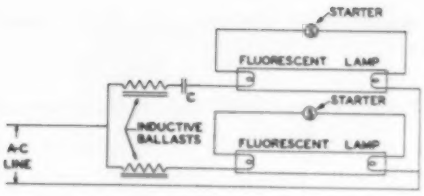
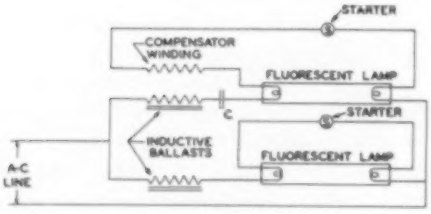


Figure 25.



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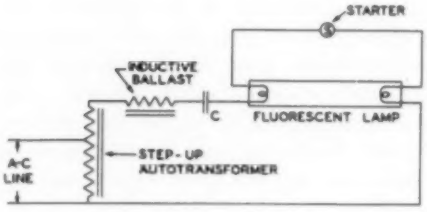

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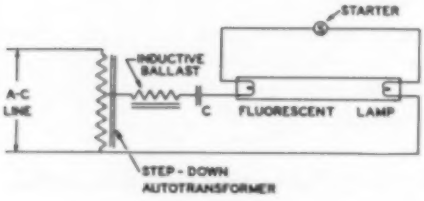

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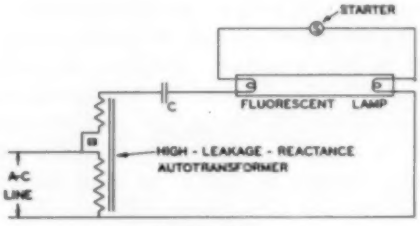


Figure 29.

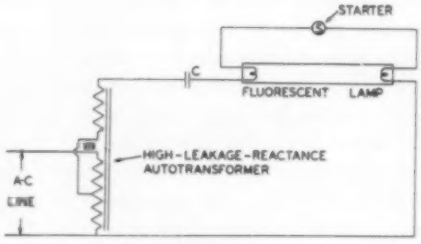


Figure 30.

High Power Factor Inductive-Capacitive Ballast Circuits

Ballast circuits of this type can be converted to high power factor by, (a) combining them with inductive ballast circuits, or (b) correcting them with an inductive element in parallel with the power supply. Fig. 25 shows the first type of high power factor circuit.

As indicated previously, the inherent starting current of this circuit is low, and it is possible to increase it by connecting into the starting circuit an inductive element which increases the current because it decreases the net impedance of the circuit.[12] Fig. 26 shows such combination. A combination of the inductive-capacitive circuit with two inductive ballast circuits can be operated at high power factor by connecting a capacitor in parallel with the supply voltage.

Low Power Factor Inductive-Capacitive Ballast Plus Autotransformer Circuits

The same autotransformer arrangement has been used with these circuit elements to start lamps which require open circuit voltage greater than 118 volts. Fig. 27 shows a circuit of this type. Fig. 28 shows the circuit arrangement when the line voltage is greater than the open circuit voltage required to start the lamp.

If the autotransformer is of high-leakage-reactance type, it is possible to use the circuit shown in Fig. 29, where the lamp starting voltage is greater than 118 volts. If the lamp starting voltage is less than the line voltage, the circuit shown in Fig. 30 may be used. In some circuit combinations the required inductive reactance can be obtained from the high-leakage reactance transformer with the secondary turns insufficient to provide the required starting voltage for the lamp. In that event, the required open-circuit voltage can be obtained without unduly augmenting the leakage reactance of the autotransformer by winding the required turns concentric with the primary wind-

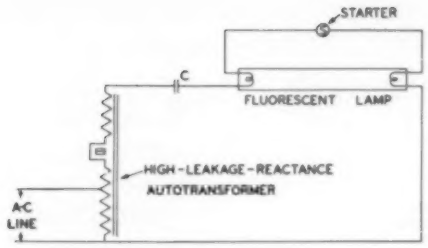
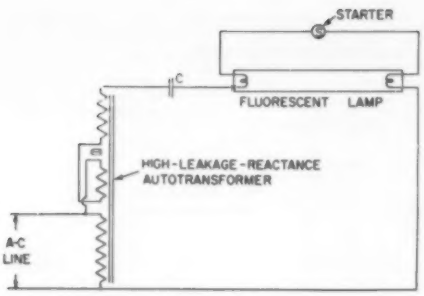


Figure 31.



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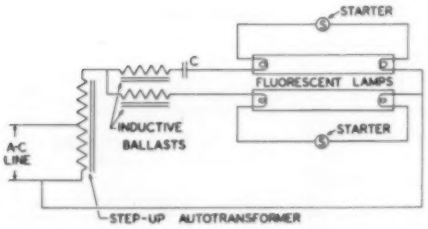

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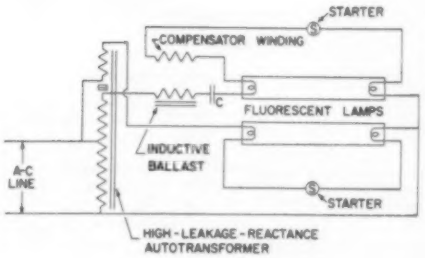

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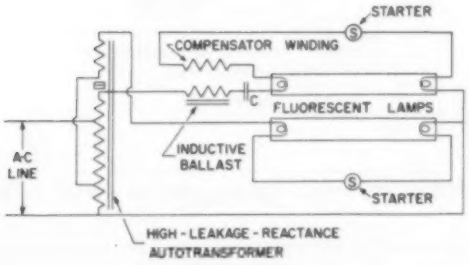

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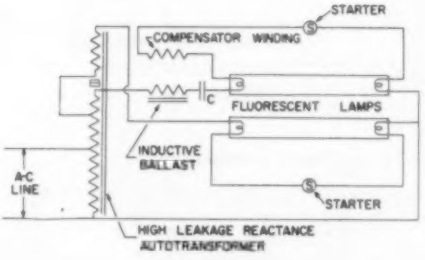


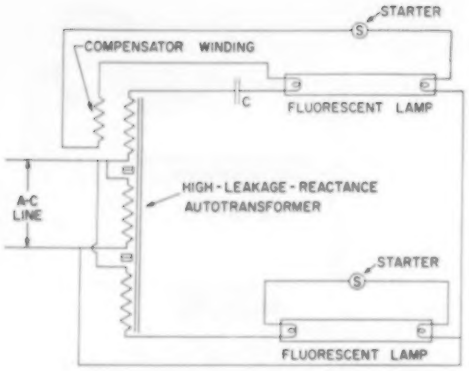
Figure 36.

ing. Fig. 31 shows this circuit arrangement and Fig. 32 shows the use of a subtractively connected winding. The addition of the compensator winding increases the lamp starting current.

High Power Factor Inductive-Capacitive Ballast Plus Autotransformer Circuits

Many combinations of autotransformer and inductive-capacitive as well as inductive ballast elements are possible. One of these combinations has been an arrangement for the operation of an inductively ballasted lamp in combination with an inductive-capacitively ballasted lamp where the latter was supplied by an autotransformer. A very widely used combination of circuit elements is shown in Fig. 33. It was this circuit that generally was used in the ballast for the operation of 40-watt switch start lamps prior to 1949. As a result millions of fluorescent lamps have been operated on this type of circuit. The three-lamp combination consisted of two inductively-ballasted lamps and one inductive-capacitively ballasted lamp with a suitable power factor correcting capacitor.

It is difficult to design the inductive-capacitive ballasted circuit using the high-leakage-reactance transformer as the inductive element, such that it will operate lamps with good lamp current wave form. Therefore, the early attempt to combine inductively ballasted lamps with inductive-capacitively ballasted lamps resulted in the use of a low reactance inductive-capacitive circuit in combination with a high-leakage-reactance inductive circuit. Fig. 34 shows this electrical circuit. When the extension winding is connected to the high potential end of the primary there are instances where the need for current limiting characteristics require the number of turns in the high reactance extension winding to be greater than is necessary



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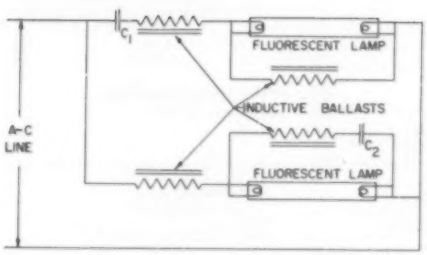

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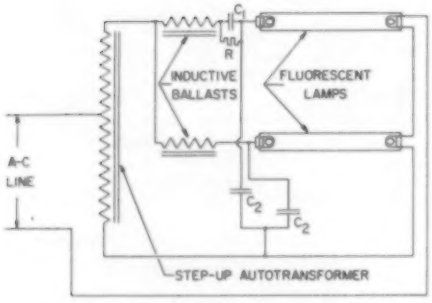
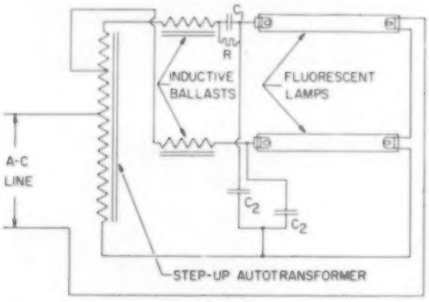


Figure 39.



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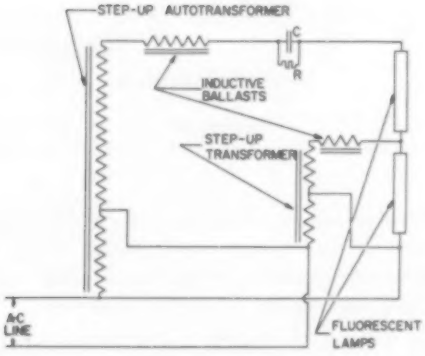


Figure 41.

to generate the voltage required to start the lamp. This creates an excessive voltage supply. Therefore, in order to obtain the correct voltage it is necessary to connect the extension winding to a primary winding tap as shown in Fig. 35. However, if the extension winding is connected to the high potential end of the primary an adequate current limiting characteristic can be obtained for some lamps, but with insufficient turns to generate the correct voltage. In such cases it is then necessary to connect the extension winding to a low-reactance extension winding tap as shown in Fig. 36.

Eventually, improvements in the knowledge of inductive-capacitive high-leakage-reactance transformer design resulted in the development of core structures which made it possible to use the high-leakage-reactance secondary in both circuits as shown in Fig. 37. This last circuit has been in constant use since 1949.

Instant-Start Ballast Circuits
Single and Multiple Lamp Circuits

The starting-switch which was so necessary to start each switch-start lamp required considerable maintenance. Therefore, early in the development of fluorescent lighting many lighting people encouraged the search for a starterless system.

It seems strange today, but some very early fluorescent lamp ballasting circuits[13] were starterless. One of these circuits[14] was investigated as far back as 1937. It is shown in Fig. 38.

When fluorescent lamp cathodes are not preheated it requires approximately 2½ times as much voltage to start them. For this reason, the circuit of Fig. 38 became uneconomical since it was neces-

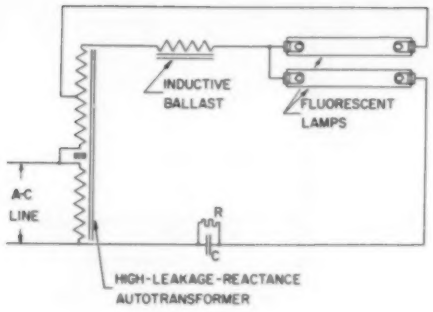
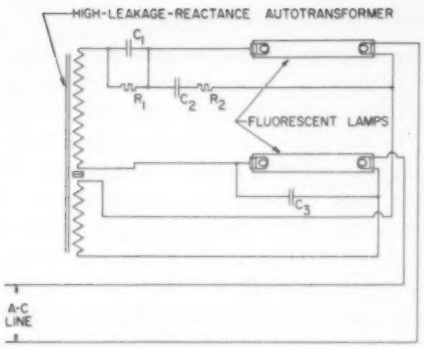


Figure 42.



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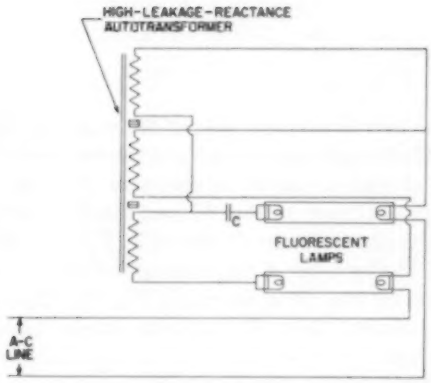

Figure 44.

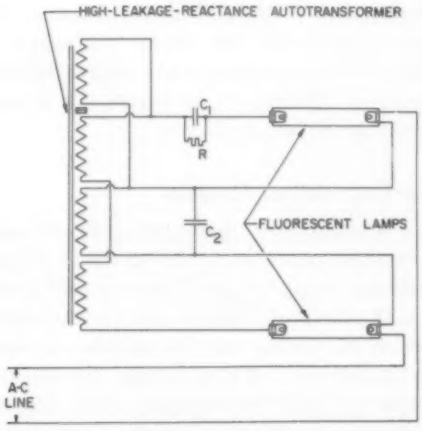

Figure 45.

sary to design it to have reasonable winding and case temperatures when either lamp failed to start. In this circuit standard fluorescent lamps are used and their cathodes shorted externally.

Somewhat later, an instant-start ballast circuit which was to become commercially important was developed. In this circuit the lamps are instant-start with cathodes designed to withstand the bombardment caused by starting without cathode preheat. Also, the voltage supplied by the autotransformer is increased sufficiently to start the lamp. This type of circuit, as shown in Fig. 39, is very satisfactory but has a rather high cost. Therefore, for a considerable period of time the price of starter elimination was high. A further modification of this circuit[15] (Fig. 40) was marketed several years later.

Ballast circuit designers directed their efforts toward the development of an instant-start circuit which would have an inherently lower cost than the one shown in Fig. 39. Some of these efforts resulted in the development of a circuit for the operation of two lamps in series.

The important feature of this circuit is that the lamps start in sequence[16] and operate in series.[17] The starting circuit does not conduct normal operating current after both lamps have started. Furthermore, the power capability of the starting circuit is much less than in any other circuit previously developed, which means that the total cost of the ballast is reduced. This circuit[17] is shown in Fig. 41.

Figs. 42[17] and 43[18] are other circuits of this type. They require a special type of disconnect lampholder and tend to slightly reduce the life of the lamps as compared to the circuit shown in Fig. 39. They are of sufficiently lower cost, however, that their commercial potential as "series sequence-start" ballasts became apparent shortly after they were marketed. For these reasons, design efforts continued and resulted in a modified circuit[19] shown in Fig. 44.

Further improvements in the circuit as shown in Fig. 45 have resulted in less difference between the light output from the two-lamps. Another modification of this circuit is shown in Fig. 46.

Trigger-Start Ballast Circuits

Lamp engineers have recognized for some time that the starting voltage of a fluorescent lamp is lower if the cathodes are heated than if they are cold. As a result, there was a long and fairly continuous search for a circuit which would provide cathode heat without the inconvenience of the starter-switch. This search finally resulted in the development of the circuit[20] shown in Fig. 47.

The important feature of this circuit is that the cathode heating circuit voltage is reduced when the lamp is in normal operation. This means that it is possible to use the regular line of fluorescent lamps in this circuit without dissipating an unreasonable amount of power in the cathodes during operation. However, this circuit has rather complicated internal wiring and a considerable number of windings. Therefore, the search for a simpler fast-starting circuit continued.

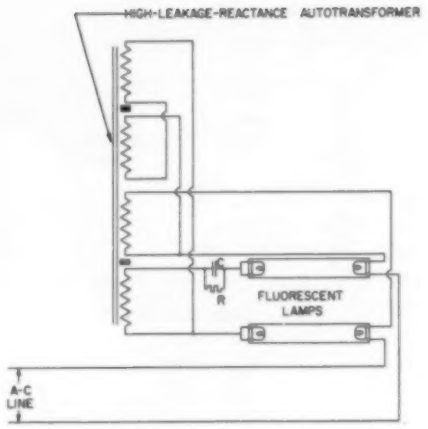

Figure 46.

Rapid-Start Ballast Circuits

A more satisfactory fast-starting circuit was developed which made use of the effects of several of the existing starting aids. This circuit[21] is shown in Fig. 48. The high leakage reactance transformer portion of the circuit may be modified to adapt it to the requirements of given lamps. By this means, the apparent inductive reactance of the circuit may be modified by making use of the circuit arrangements shown in Figs. 30, 31 and 32. The development of rapid-start lamps enabled circuit designers to use known principles for dimming and flashing. These could not be exploited until continuously heated cathode lamps were available.

Magnetic Ballast Circuits

For Simple Inductive Ballast Circuits

The electrical circuit shown in Fig. 8 uses a core structure for the inductive ballast which is similar to the one shown in Fig. 49. The leakage flux from the outside legs linking the ballast case and fixture causes noise. Therefore, it was necessary to develop and use a magnetic circuit with center leg air gap. In some instances it was desirable to reduce the amount of leakage flux further by interleaving the outside legs.

For the Inductive and Inductive-Capacitive Ballast Plus Autotransformer Circuits

It is possible to reduce the amount of magnetic material used in magnetic ballast circuits for an electrical circuit of the type shown in Fig. 15. This is done by using one yoke section of the autotransformer core as common part of the magnetic circuit of both the autotransformer and the inductor. This type of core structure is shown in Fig. 50. The electrical circuit of Fig. 16 and similar modifications of the basic circuit shown in Fig. 15 may be fitted to this type of magnetic structure. Another version of Fig. 50 is shown in Fig. 51. The magnetic circuit,[22] Fig. 51, has some special features. They are:

(a) The core structure may be held together by means of wedges under the coil.

(b) The autotransformer portion includes a series air gap which may be designed to correct the power factor of the electrical circuit when the lamp is ballasted by means of an inductive-capacitive ballast circuit.

As indicated previously high leakage-reactance autotransformers were used to ballast lamps quite early in the development of fluorescent lighting. The popular core structure shown in Fig. 52 was used for the electrical circuit shown in Fig. 17. Without modification of the magnetic circuit it was possible to use it for the electrical circuits shown in Figs. 18, 19 and 37. More recent modifications of the basic high reactance core have resulted in the use of a core structure like the one shown in Fig. 53.

In order to reduce the cost of the core structure for the electrical circuits of the type shown in Figs. 34, 35 and 36, it was desirable to use the core structure shown in Fig. 54. The window at the right end of the core structure contains the high leakage reactance secondary which is the inductive type ballasting component of the electrical circuit shown in Fig. 34. The central window of this core structure contains the primary winding and the low

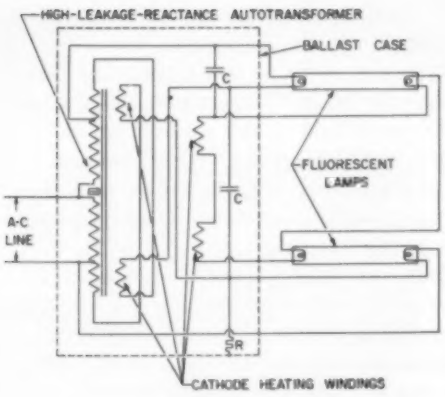

Figure 47.

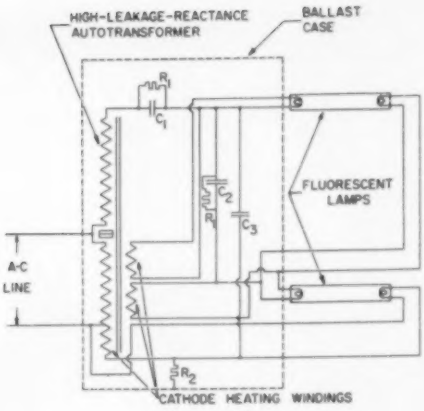

Figure 48.

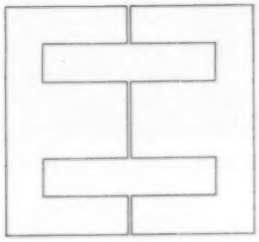

Figure 49.

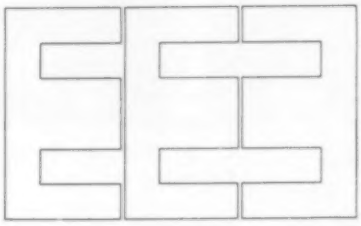

Figure 50.

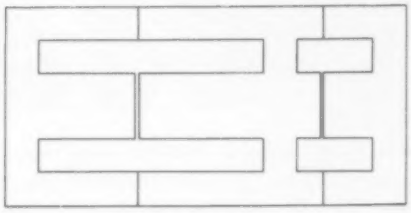

Figure 51.

Figure 52.

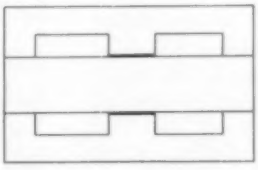

Figure 53.

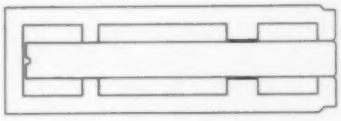

Figure 54.

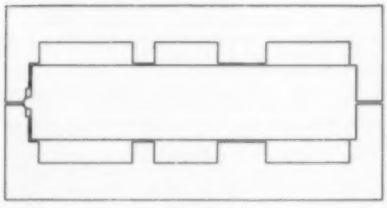

Figure 55.

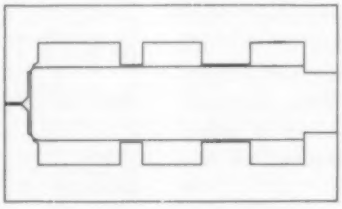

Figure 56.

Figure 57.

leakage reactance secondary or extension winding. The remaining window holds the inductive ballast element in the inductive-capacitive ballast circuit.

The core structure[23] suitable for the electrical circuit shown in Fig. 37 is shown as Fig. 55. A modification of the structure shown in Fig. 55 resulted in a more economical core structure[24] as shown in Fig. 56. The air gap in the end of the central winding leg of the core structures shown in Figs. 55 and 56 is designed to control the operating density of the secondary magnetic circuit.

Designers soon found another way to accomplish this control by using bridged air gaps[25,26] within the central winding leg as shown in Fig. 57. These gaps control the flux density in the secondary magnetic circuit just as well as the series air gaps shown in Figs. 55 and 56. This innovation has an advantage in that length of the principle series air gap is determined by the die and is not a function of the intimate assembly of the core structure. Another distinct advantage of the core structure shown in Fig. 57 is that it can be produced with

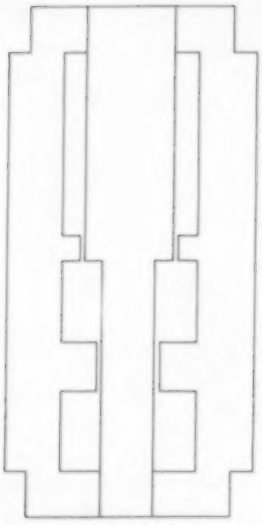

Figure 58.

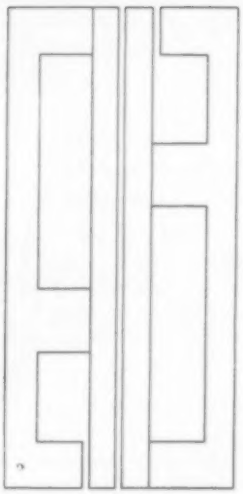

Figure 59.

less scrap or waste material than those in Figs. 55 and 56. Fig. 58 shows another magnetic circuit which enables the designer to control the flux density in the secondary magnetic circuit by increasing the cross-sectional area of the secondary magnetic circuit. One final mechanical arrangement[27] of the magnetic circuit for the electrical circuit of Fig. 37 is shown in Fig. 59. This resulted in interdependence of lamps which has reduced designer interest in the circuit.

Future of Ballast Circuitry

This paper has presented the major developments in the field of circuits for fluorescent lamp ballasts. It represents an indication of the advances which have been made in fluorescent lighting during the past eighteen years. These improvements are far beyond the expectations of many lighting engineers who were the pioneers of this business back in 1940.

Viewing these advances today we are inclined to ask, "What does the future hold?" The possibilities are myriad. However, with our present knowledge we can expect the influential factors to be the continuing trend toward higher power levels for lamp operation and the efforts to increase lamp efficiency. To the circuit designer this means developing ballasting systems which will operate from higher voltage sources and the creation of more specialized equipment such as static and rotating frequency converters.

We can go even one step further and ponder the changes in design of components or arrangements which could lead to the general use of high frequency lighting systems. We should also consider the possibilities of using a ballast as a device for the operation of electroluminescent lamps at higher than power frequencies.

Thus, the circuit designer of today can be the architect of tomorrow's lighting systems. The challenge for future development is ever present. It is hoped that this paper will be a useful guidepost of the past and present for those who are engaged in working toward the future in the field of lighting circuitry.

And finally, the author would like to thank the many people in the Large Lamp Department and the Ballast Department of the General Electric Company whose unselfish efforts have made this paper possible. Special acknowledgement is due: R. N. Thayer, D. D. Hinman, and Miss Edith Oderkirk.

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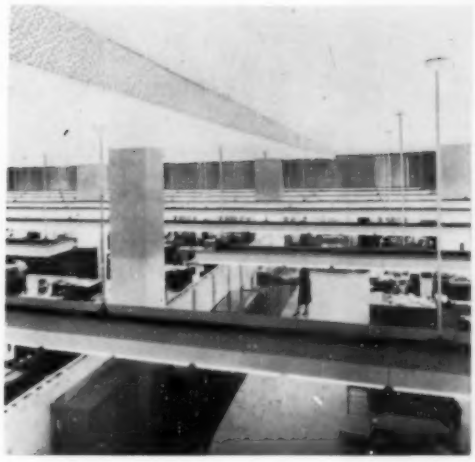


Lowering Apparent Ceiling Height

ORIGINALLY this job was designed for mounting continuous rows of luminaires to a dropped acoustical tiled ceiling mounted at 11 feet above the floor. However, the bid price of the job exceeded the budget so something else had to be done.

The architect, Edward Paige, and his electrical contractor, Clyde Bentley, elected to leave the original ceiling at 18 feet, to save costs involved in bringing the actual ceiling down. James L. Dellos, electrical contractor, was consulted for the design of a suspension method which would neatly accomplish the low-ceiling effect desired. The lighting system had been laid out for a 50-ft-c installation; comfortable brightness ratios and even distribution were, of course, required.

Six-foot rigid conduit stems and canopies were employed, with continuous rows of two-lamp 96-inch slimline vinyl-bottomed luminaires mounted on 11-ft centers, 11 feet above the floor. Installing the long runs of luminaires so that all rows were perfectly aligned in either direction and were level to the eye without regard to dips in either floor or ceiling, was something of a problem. Single channel sections were mounted to the midline on top of the luminaires, as shown in the photograph at left. Note that the conduit stems are connected to the channel with longitudinal swivel hangers to allow for earthquake or other action. In mounting the fixtures to the channel, workmen made sure that each was balanced on the channel. After balancing each fixture along the line, they were bolted to the next unit, forming a rigid line. Access holes were cut in the ceiling every 8 feet to allow rod supports to be fastened to the concrete floor above, and also to slip the 10-foot lengths of conduit along the proposed stem line above existing ceiling. The rod supports were anchored to the slab by half-inch concrete shields which in turn supported the conduit using clevis hangers.

Special eye-loop hangers were developed with vertical, horizontal and longitudinal adjustment capable of supporting both channeling and fixture. For this a half-inch rod was bent over the circumference of the conduit above the acoustical tiles, forming an eye bolt extending below the finished ceiling line. Stems with canopies were then connected to the eye bolt in the usual manner at the access holes.

The finished job gave the impression of a lowered ceiling without the feeling of confinement.

Installation at the Continental Casualty Co. office; entered by J. L. Dellos, Emil J. Weber Electric Co., San Francisco, in the contest for My Most Interesting Lighting Job, conducted by Golden Gate Section of I.E.S.

Task at left is to unwrap several turns of 9/10 mil wire from the end of the coil in preparation for an electrical connection to be made at a later time. The unraveled wire will be hand-fed through a small hole in the outside case before final connection.

Precision Seeing Tasks

. . . and how to light them

By WILLIAM N. SEMPLE

OUR LIGHTING installation for the new buildings of the Helipot Corporation in Costa Mesa, California, was designed to conform to the Illuminating Engineering Society's recommended practices for areas of this nature. Several months' experience with it has led us to feel glad that it was! The production of electronic components dictates cleanliness, efficiency, reliability and miniaturization in designs. These stringent requirements emphasize the important part that quality lighting plays in our ability to produce these precision com-

This installation took second prize in the contest for My Most Interesting Lighting Job, conducted by the Southern California Section of I.E.S. AUTHOR: Manufacturing Director, Helipot Corporation.

At right is an assembly operation which requires the operator to pick up a tiny screw with a pair of tweezers and insert it in the top of a potentiometer.

Assembly Department where 180 footcandles are maintained at the bench operating level. Note the microscopes; of 400 employees in this department, 70 of them work eight hours a day with microscopes. Operations performed are so precise that supplementary lighting to a level of over 400 footcandles is required.

ponents successfully. A single reject can cost us several hundreds of dollars in labor and material.

In these buildings we have an average, maintained illumination of 180 footcandles. We designed for this level especially to meet the visual needs for seeing small objects accurately and quickly. Visual comfort was achieved by attention also to the principles applying for quality of the illumination.

Essentially the system involves continuous rows of industrial luminaires slotted for a 15 per cent upward component and using 96-inch high output standard warm white lamps, high power factor ballasts, and operated at 800 ma. We have used a standard nine-foot mounting and eight-foot spacing distance throughout the plant, which incidentally is powered by a 480Y277-volt system.

Contributing to both the quantity and the quality of the illumination are light colors, for equipment as well as other surfaces. The ceiling, of course, is of very high reflectance to get full benefit of the upward component of the luminaire. As owners and operators of an industrial plant, we have learned from experience that a good lighting job does not end with its proper installation. Maintenance, we have found, is an extremely important function, relating directly to production decreases and increase of rejects, in direct ratio with a loss in light output. To avoid this problem, our plant has set up a cleaning and relamp schedule for all departments.

During the 20 years in which I have been engaged in the business of manufacturing precision electro-mechanical components, I have been directly associated with the illumination of several office, engineering and factory facilities. I can well remember the day when the lighting industry considered 50 footcandles at bench level a major achievement. Over the years I have been able to make a first-hand evaluation of the progress of illuminating engineering. I want to take this opportunity to say that, in my opinion, the progress which has been made in lighting is a major contribution to industry's ability to increase production and reduce costs of both civilian and military products.

Surgical Lighting-A Glimpse at Its History

By E. H. GREPPIN

RIGHT UP to the 1920's, hospitals depended to a very great extent on natural light admitted through very large windows. With the development of efficient and relatively cool electric light sources, however, artificial lighting has become the chief source of illumination in hospitals. Instead of the enormous skylights and windows of by-gone years, hospital operating rooms of today have for the most part relatively small windows, sometimes even opaque or semi-opaque. In fact, some modern surgeries have no windows at all. Intracavity illumination today is, almost without exception, from artificial sources.

It is only in the very recent past that scientific thought has been given to certain problems of surgical vision—namely, color of light and the study of the correct quantity and quality of light reflected from surgical areas to give surgeons the precise vision they need. In fact, during the last ten years there have been so many developments in surgical illumination that the lighting devices of even six years ago are not comparable with today's systems, and the resulting seeing qualities scarcely bear a resemblance to those of ten or twelve years ago. It may be interesting to outline briefly the steps in this development.

AUTHOR: Manager, Light Department, Wilmot Castle Company, Rochester, New York.

Dr. Willard Bartlett, in about 1915, working in conjunction with Edwin F. Guth, Sr., designed a luminaire which is credited with being one of the first developments toward today's type of surgical illumination. This unit in an operating room prior to 1920 is shown in Fig. 1. Although it was a major step forward it did have the disadvantage of being rather low in illumination level, and rather hot. Known as the Bartlett No-Shadow Light, it became the most popular surgical luminaire of its day.

The Scialytic, which originally appeared in this country in the early 1920's, was the development of a professor of physics at Algiers and marked a decided step forward in the production of concentrated shadow-reducing light for surgical areas—Fig. 2.

About this time also came the Operay light developed by Patrick Nirdlinger of Chicago who first introduced the idea of mounting the lamp on a flexible mounting, with the lamp on a straight counter-balanced cross arm—Fig. 3.

Figure 1. The operating room at St. Mary's Hospital, Rochester, Minn., taken about 1915, showing one of the first installations of the Bartlett No-Shadow Light.

Figure 2. An early installation of the Scialytic lamp.

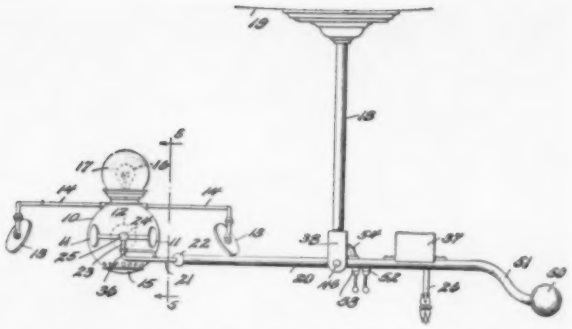


Figure 3. Patent Office drawing of Nirdlinger's early light; prior to 1925.

Heat and Color Filters Introduced

The next major development apparently was first conceived in Germany by the Carl Zeiss Company. This involved an elliptical reflector in conjunction with *heat* absorbing glass—Fig. 4.

In the late twenties the use of heat-absorbing glass was used in this country by the late Norman Macbeth, Sr. of New York City, and by the author. The first showing of equipment making use of heat-absorbing glass was at the American Hospital Association meeting in 1929.

This marked the beginning of the present era of surgical illumination—for without heat-absorbing glass the levels of illumination required from present day surgical lamps would be impractical, due to the extreme heat generated by such high intensity lamps.

Heat-absorbing glass was originally developed by Sir William Crookes about 1880, but its application to problems of surgical illumination did not come until the advent of the concentrated filament bulb which permitted focusing an intense light from a reflector. Glass manufacturers have carried on the development to its present highly efficient state wherein a plate 4mm thick will absorb 87 per cent of the radiant heat.

Glass manufacturers have also done much work in color correction of such glass. The original heat-absorbing glass had a distinct greenish cast. Through research, glass has been developed which provides light having a well balanced white color suitable for color photography.

The development work since the advent of concentrated filament lamps can roughly be divided into six groups. The first, of course, was increased intensity made possible by the concentrated filament lamps. The second was the introduction of

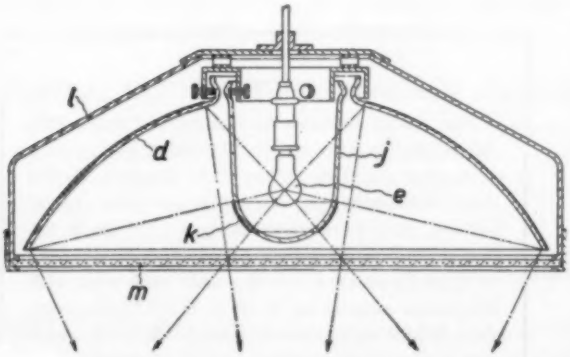


Figure 4. Zeiss, in 1928, introduced the heat absorbing glass (j) and elliptical reflector (d).

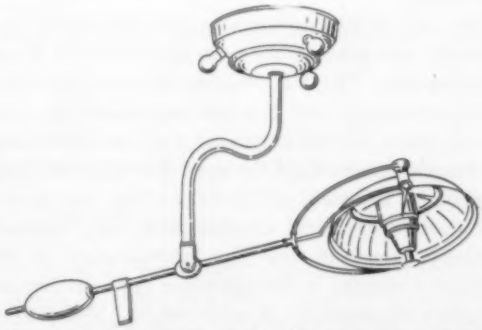


Figure 5. Later model of the Scialytic lamp, 1934.

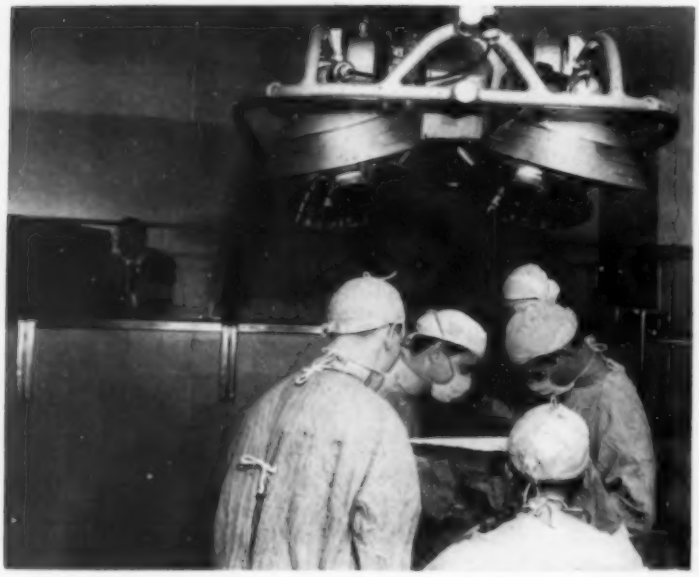


Figure 6. Television installation at the University of Pennsylvania Medical School.

heat-absorbing filaments which became necessary with the concentration of light and following this, color correcting filters were necessary.

The third major change was in mounting the lamps in such a manner as to aid in the projection of the beam of light into the incision. The offset mounting with its rear end control, so that the nurse could adjust it from out of the sterile field, was incorporated on a Scialytic-lamp by Frank Rice about 1934, at that time Manager of the Scialytic Corporation of America—Fig. 5.

With increasing illumination levels, glare became a major factor and it was necessary to take steps to minimize the reflection from instruments. Also the use of blue-green-gray rather than white surgical draping came into general practice.

Another major step was in the development of safety factors as are now outlined by the National Fire Protection Association in their bulletin No. 56. With this came the requirement for explosion-proof portable lamps of high efficiency and ease of operation.

The use of photography as teaching media was brought into prominence with the advent of Kodachrome film. The high degree of color correction required for all color film has emphasized the need for accurate control of the color of the light beam. It has also emphasized the need for uniform illumination of the surgical cavity, so that one area is not over-exposed and another area under-exposed.

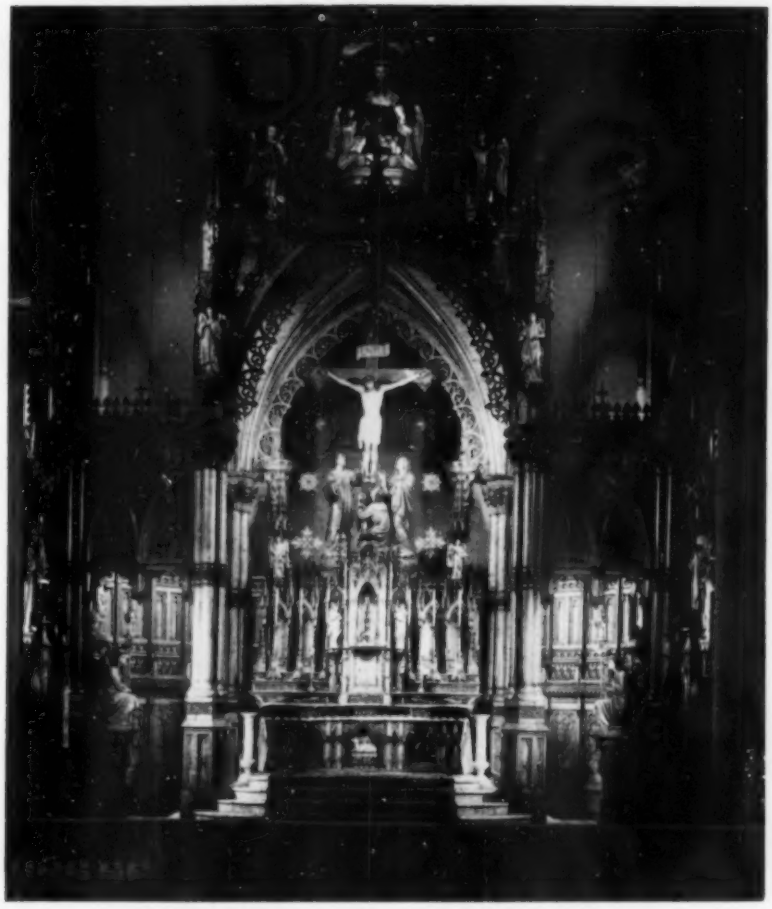
Color television and the incorporation of the television camera in the operating light further emphasizes the necessity of good surgical illumination without excessive glare or contrast—Fig. 6.

Attempts have been made to build an operating light consisting of a complete or partial ceiling of spotlights so that there would be no moving light. This was first done witih a flat ceiling. Then the ceiling was made in the form of an ellipsoid, so that the beams of light could be directed in from low angles.

As illumination for general surgery improved, lights especially adapted to particular types of surgery have been developed. The basic type at present is the overhead light for the usual run of abdominal surgery, and so the average major operating light is particularly designed for abdominal and perineal work. It is always possible to build lamps adapted especially to a special type of surgery, but as nearly all operating rooms are used for general surgery, a compromise design has been generally adopted in most areas.

Errata

The fourth sentence at the top of page 372, July I.E., in the article "Dental Lighting — A Glimpse at Its History," by E. H. Greppin, should read: "Dental supply companies now offer special lighting units particularly designed for use in the dental office which deliver illumination levels of 60 or more footcandles over the chair work area, with brightness ranging up to 50 or more footlamberts from bright surfaces and instruments in the work area.



INSTALLATION AT ST. STEPHEN'S CHURCH
1930 W. 54TH ST., CLEVELAND, OHIO.

Lighting a Chancel

LIGHTING OBJECTIVE: To provide accent lighting in a church to beautify the chancel and to focus the attention of the congregation.

GENERAL INFORMATION: Reflectances of various surfaces in the chancel of this traditional style church are as follows:

Wood Carvings	25% RF
Gray Stone Columns	30% RF
Stone Steps	55% RF
Carpet	15% RF
Green Sanctus Cloth on Tabernacle Table	12% RF

INSTALLATION: Lighting is provided by ten NL Corporation luminaires (catalog No. CH215) each equipped with three 150-watt PAR-38 flood lamps, mounted in gimbal rings for adjusting Fig. 2). As it can be seen in Fig. 3, three of these units are mounted behind the column at either side of the sanctuary. Two units are mounted within the wood carvings on either side to

(over)

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Figure 2. (right). Close-up of luminaire.

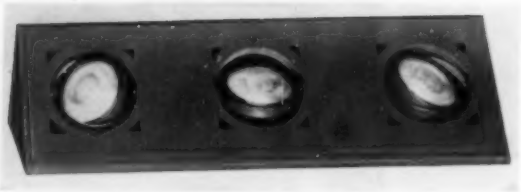

Figure 3. View showing location of several luminaires.

Figure 4. Locations and values of brightness readings.

floodlight the crucifix and the immediate surrounding area. Eight 150-watt R-40 flood lamps are also located behind the wood carvings for highlighting the religious art objects. All lighting equipment is out of sight of the congregation.

Illumination values are as follows:

Prayer Rail	5 ft-c
Tabernacle Table	
General	30 ft-c
Prayer Book Location	50 ft-c

Brightnesses are as shown in Fig. 4.

Lighting designed by M. W. Terkel, NL Corporation, Cleveland, Ohio.

Lighting data submitted by Richard L. Cooper and Anson H. Russell, General Electric Co., Cleveland, Ohio, as an illustration of good lighting practice and to aid in the design of similar installations.

Published by the Committee on Publications of the Illuminating Engineering Society, 1860 Broadway, New York 23, N. Y.

Series XXI 8-57

Striking Potentials of Long, Low Pressure Mercury-Argon Electric Discharges

By ROBERT H. McFARLAND, CLARENCE A. BELL, JOHN LADESICH, RICHARD A. ANDERSON, and RAIMO BAKIS

THE DEGREE of complexity and variability of the phenomena involved in the striking of an elongated low pressure arc has caused most researchers to avoid this research area. In this work an attempt has been made to simplify and control these phenomena to a greaater degree than has been practiced in the past.

Arc starting, preceded by a glow, occurs when the abnormal glow current reaches a threshold current value which is apparently needed for "conditioning" the cathode for emission. This threshold current is dependent on fill gas and electrode construction but not, apparently, on gas pressure within experimental error or electrodal separation. Thus, predictions of changes of arc striking potential caused by changing lamp geometries and pressure are possible from well known theories concerning the effect of these changes on abnormal glow operating voltages and currents.

Glow striking voltages in such discharges must be great enough to provide for the initiation of a Townsend discharge from the high voltage electrode to the nearest grounded surface and for the extension of the discharge down the lamp to the grounded electrode. The first requirement approximates Paschen's conditions and results for the initiation of short glow discharges. The extension of the discharge down the lamp does not seem to have a developed analogy in present theory, but yields to simple empirical analysis.

Introduction

Many investigators have attempted through the work of Paschen,[1] Penning and Addink,[2] and others to predict the striking potentials which might be expected for a lamp of the type of the conventional instant starting fluorescent lamp. Unfortunately, there is little direct comparison to be made between the different systems. The elongated fluorescent lamp operating as an alternating current arc has its own individual characteristics which must be evaluated before such prediction is possible.

One of these characteristics is involved in the starting of elongated lamps with direct current potentials.[3] The striking potential which is observed is dependent on the length of time prior to starting during which the potential is applied. This is due to the charging of the lamp wall with electrons from the cathode which may elevate the minimum lamp striking potential of a 40T12 instant starting lamp by a factor of five or more.

Secondly, when the lamp is started and operated as an alternating current device to minimize and stabilize the wall charging effect, nearby capacitive objects influence the striking potential as does the grounding of the starting circuit.[4]

Lastly, the surface resistance of an alternating current lamp has been determined to influence its striking potential.[5,6]

The investigation described in this paper controlled these characteristics and measured the variation of striking potentials versus argon pressure and interelectrode distance.

Apparatus and Method

A special lamp, Fig. 1, was constructed of 40 mm O.D. Pyrex glass tubing. The triple-wound coiled-coil, triple carbonate coated, tungsten electrodes were designed so that one of the electrodes was movable. Preparation of the lamp included evacuation and outgassing by baking in a 400°C oven. The vacuum system, itself, was thoroughly outgassed by flaming where possible and by the use of a Tesla coil in the vicinity of greased joints. With appropriate liquid air trapping, pressures of the order of 10^{-6} mm of mercury were experienced. Within the lamp the vapor pressure of an excess of mercury determined the lowest pressures obtainable. Water cooled, mercury, diffusion pumps were backed by a Cenco Megavac fore pump for providing the vacuum.

The lamp was processed in a fashion comparable

This paper is partially an adaptation of a thesis presented by C. A. Bell as partial fulfillment of the requirements for the degree of Master of Science in Physics at Kansas State College. The work is supported by the Office of Ordnance Research, U. S. Army.
AUTHORS: Department of Physics, Kansas State College, Manhattan, Kansas.

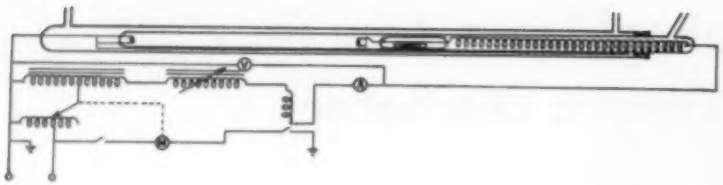

Figure 1. Movable electrode discharge lamp, grounded water jacket, and electrical circuit used for measuring breakdown potentials.

to that of a commercial lamp until its starting and operating voltage compared favorably with that of commercial lamps of the same size.

The lamp was then encased in a grounded water jacket which served to control the mercury temperature and to provide a grounded conductive coating adjacent to the lamp surface. This latter provided the necessary protection against the humidity effect and furnished the necessary nearby capacitive body to insure minimum striking potentials.

The electric circuit used for starting and operating the test lamp is also to be seen in Fig. 1. The lamp voltage was uniformly increased at the rate of 25 volts/sec by means of a motor driven variac operating in the primary of the lamp transformer. Readings of voltage were R.M.S. voltages read with the voltmeter connected directly across the lamp or across a high resistance voltage divider when the voltage was above 750 volts. This voltage included the potential drop across a 40-ohm nichrome loosely coiled connecting wire within the lamp. For most instances the current was so small as to make this drop of no importance.

The lamp gas was a mixture of argon and triply-distilled mercury. The mass-spectrographically analyzed argon had specified impurities of less than 0.005 mole per cent of any single impurity.

Argon pressures were measured with a Dubrovin gauge. Mercury pressures were determined by the temperature of the water jacket in which the inlet temperature was 22 ± .5°C, and the outlet temperature was 22.7 ± .5°C. The mercury pressure determined by these temperatures was of the order of 10^{-3} mm of Hg; but more important, it was relatively constant.

Experimental Results

The experimental results of this work are presented in Figs. 2 and 3. Each point of these curves is the average of at least six different measurements taken during two different lamp fillings and subsequent reductions in lamp pressure. The deviation from the mean was as great as ten volts for the individual requirements. Prior work with other lamps and gases provided the experience to make these specific measurements possible.

Discussion of Results

Earlier work[7] has described three distinct steps as occurring in the high voltage initiation of an elongated low pressure arc discharge. A low current visible discharge of the order of 10^{-6} amperes is first struck between the ungrounded electrode and the adjacent lamp surface. In the present case this distance, to be referred to as d', was about one and one-half centimeters.

As the lamp voltage is increased, the lamp current increases by using a larger portion of the internal lamp's surface as its grounded electrode. Since the effective electrodes are not parallel, this activity, comparable to that observed in a normal glow, is not accomplished with constant lamp volt-

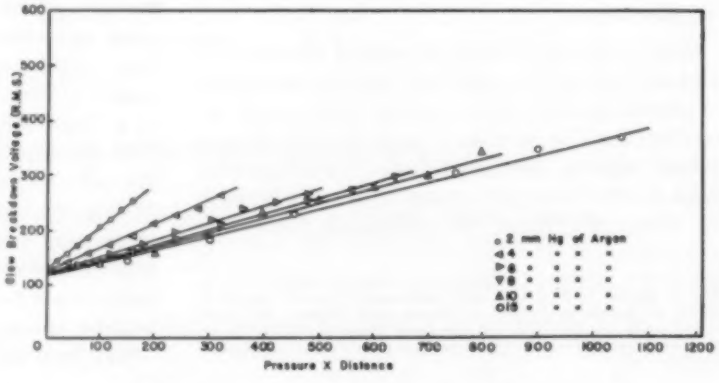

Figure 2. Glow breakdown potentials as a function of the product of pressure and distance (mm of Hg × cm) for constant argon pressures.

age. When the lamp current has extended down the lamp to the vicinity of the grounded electrode, the discharge transfers to become fixed between the two electrodes. The potential at which this occurs corresponds to a lamp current of the order of 10^{-3} amperes and is the glow breakdown voltage shown plotted against the product of pressure and inter-electrodal distance, d, for constant pressures in Fig. 2.

The glow striking or breakdown voltage as here defined is a linear function of Pd and can be expressed as

$$V_{sg} = A + bPd \qquad (1)$$

with both A and b dependent on P. One can also write this result as:

$$V_{sg} = A + Bd \qquad (2)$$

The value of A is relatively constant for all pressures at approximately 120 volts and probably represents the potential required to initiate a discharge through the distance d. This would be consistent with our earlier work[8] and, also, work of Druyvesteyn and Penning[9] in which a minimum striking potential for barium electrodes in argon was observed to exist at Pd values below one mm times cm and to be of the right order of magnitude when our potentials are corrected to peak voltages.

In equation (2), B, which is a constant for a given pressure, represents the potential gradient necessary to spread the discharge down the lamp. Here, again, the familiar relationship concerning field strength, X, and pressure appears.

$$(X/p) = b$$

Its meaning is different, however, as b is pressure dependent. This dependency is approximated by the following empirical relationship[10] for the conditions of this experiment.

$$b = 1.9 + \frac{.68}{P-1}$$

The initiation of the arc occurs when glow discharge current and voltage become sufficient to condition the electrodes for the higher needed current emission. While little enough is known about the relative contributions within the discharge which cause the higher emission, it occurs when the glow current reaches approximately 3×10^{-2} amperes at all pressures observed in the present investigation.

Thus the arc striking or breakdown voltage when a glow precedes the arc is the glow operating voltage which produces a necessary minimum operating current. Its dependence on Pd can be observed in Fig. 3 where the curves are linear functions of Pd and are parallel to a first approximation. Thus, the arc striking potentials can be represented as

$$V_{ss} = A' + b'Pd \qquad (3)$$

where A' is a function of pressure and b' is constant for all pressures. (Measurements at 2 mm are not entirely reliable as starting at these pressures tends to destroy the cathode and thus the lamp may not be entirely comparable to that used at the other pressures.)

Remembering that the arc striking voltage is equal to a glow operating voltage for a constant glow current of approximately 3×10^{-2} amperes, one may write

$$V_{ss} = V_{sg} = |\vec{V}_e + \vec{V}_p| = A' + b'Pd \qquad (4)$$

where V_e and V_p are the electrodal and positive column drops, respectively. X_p, the potential gradient of the positive column is given by

$$X_p = \frac{V_p}{d} = b'P = .235P \qquad (5)$$

which is to be expected for systems in which the lamp radius, fill gas, current density, and presumably the electron temperature remains constant. In the case under examination, the current density is low and constant for each starting condition. It

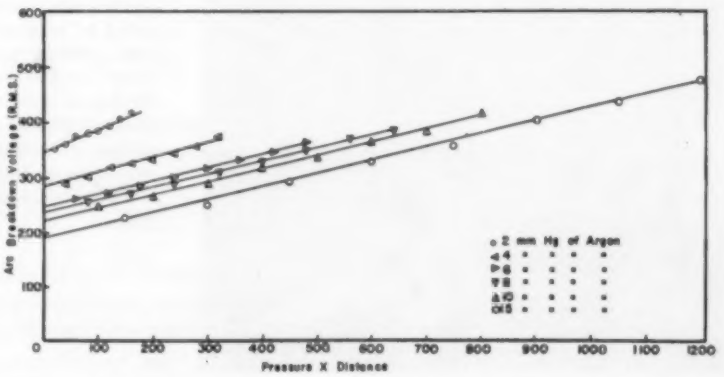

Figure 3. Arc breakdown potentials as a function of the product of pressure and distance (mm of Hg × cm) for constant argon pressures.

is reasonable that as increasing pressure decreases the mean free path in the positive column, the potential gradient must increase to provide the same degree of ionization and current density.

By assuming that the cathode drop, V_c, is much larger than the drop at the anode, that V_e and V_p can be added linearly, and that the cathode drop length is small, one may set:

$$V_e = V_c = A' \qquad (6)$$

Loeb[11] has cited the work of Von Engel and Steenbeck and discussed the dependence of V_c on current density and pressure for a glow discharge. Corresponding to the data of Fig. 3, for an abnormal glow in which the current density is held constant, one expects the value of V_c to decrease for increasing P.

This tendency is noted here where A' can be represented empirically by:

$$A' = 48.5 + 377/p^{1/5}$$

This was determined by plotting the ordinate intercepts of Fig. 3 versus $1/pn$ for various numerical values of n until a linear relationship was observed and the appropriate constants could be evaluated.

Conclusion

The striking potentials of an elongated variable length lamp have been measured and have been observed to vary as linear functions of the product of the lamp pressure and its length.

The observation that the arc striking potential, preceded by a glow, is the glow operating voltage at which a constant threshold current necessary for the "conditioning" of the electrodes to provide the necessary emission has been useful.

Additional work is underway with various gas mixtures and pure gases to extend these observations.

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Fluorescent Used In High Bay Area

Illumination, at three feet from the floor, is 25-30 footcandles at the Bath Iron Works, Bath, Maine, provided by twenty rows of nine each of two-lamp industrial reflector units using F96T12 cool white rapid-start lamps on 800 ma. Units have 19 per cent uplight and 30-degree crosswise shielding, and are mounted on channel 50 feet from the floor and five feet from the ceiling. The finished ceiling is fiberboard painted with two coats of flat white. Bays are 25 feet.

Photo courtesy Smitheraft Lighting Division, Chelsea, Mass.

INSTALLATION AT CHICAGO PARK DISTRICT GRANT PARK UNDERGROUND GARAGE
25 NO. MICHIGAN AVE., CHICAGO, ILL.

Lighting an Underground Garage

LIGHTING OBJECTIVE: To illuminate the thoroughfares and parking areas of a garage to facilitate car movement and to minimize traffic hazards.

GENERAL INFORMATION: This garage contains two underground levels with approximately 880,000 square feet total floor area for parking 2359 automobiles. All surfaces are of smooth finish light gray concrete of 55% reflectance except for mottled gray tile walls, in the main thoroughfare, of 75% reflectance. The ceiling heights are 8 feet.

INSTALLATION: The average illumination level in the main thoroughfare (Fig. 1) is 22 footcandles maintained in service. This is produced by twelve Solar Light Manufacturing Co. (catalog No. 33239A with Corning Alba-Lite Glass No. 66 panels) recessed fluorescent units per 30-foot bay, staggered in rows six feet on centers. Each unit is equipped with two 40-watt T-12 standard cool white lamps.

The average illumination level in the parking areas (Fig. 2) is 5 footcandles maintained in service. (10 in the central portion of each bay.) This is produced by one Solar Light Manufacturing Co. (catalog No. 33240 with Corning Alba-Lite Glass No. 66 panels) surface mounted fluorescent unit centered in each 30-foot bay. Each unit is eight feet long and is equipped with four 40-watt T-12 standard cool white lamps.

(over)

A.I.A. File No. 31

Figure 2. View of parking areas.

Brightnesses in the two areas are as follows:

Main Thoroughfare			
Luminaires			
crosswise	at 25°	(7 ft. driver distance)	650 ft-L
	at 10°	(20 ft. " ")	500 ft-L
	at 5°*	(40 ft. " ")	450 ft-L
lengthwise	at 25°	(7 ft. " ")	700 ft-L
	at 10°	(20 ft. " ")	400 ft-L
	at 5°*	(40 ft. " ")	250 ft-L
Ceiling			5 ft-L†
Floor			12 ft-L†
Parking Area			
Luminaires			
crosswise	at 25°	(6 ft. driver distance)	650 ft-L
	at 10°	(18 ft. " ")	750 ft-L
	at 5°**	(35 ft. " ")	1600 ft-L
lengthwise	at 25°	(6 ft. " ")	700 ft-L
	at 10°	(18 ft. " ")	600 ft-L
	at 5°	(35 ft. " ")	450 ft-L
Ceiling (adjacent to luminaires)			250 ft-L

*At 5° crosswise the projected area is about 1" x 48", lengthwise 9" x 4.5".
**At 5° crosswise the projected area is about 3" x 48".
†Estimated for new conditions and reflectances as shown above.

Lighting designed by R. L. Craig, Ralph H. Burke, Inc.; Electrical contractors: White City Electric Co., and J. Livingston Co., Chicago, Ill.

Lighting data submitted by Solar Light Manufacturing Co., 1357 S. Jefferson St., Chicago, Ill., as an illustration of good lighting practice and to aid in the design of similar installations.

Published by the Committee on Publications of the Illuminating Engineering Society, 1860 Broadway, New York 23, N. Y.

Lighting of Indoor Locations of Central Station Properties

Prepared by the Subcommittee on Lighting of Indoor Locations of the Committee on Lighting of Central Station Properties of the Illuminating Engineering Society

Foreword

The lighting of Central Station properties, and especially generating and substation areas, presents many peculiar seeing problems and conditions which are not typical of work areas in general. Accordingly, in 1948, the IES Council established a committee on the lighting of Central Station properties to study conditions and prepare general recommended procedures to serve as a guide for the industry. Four of these reports, "Lighting of Control Rooms," "Lighting of Load Dispatch Rooms," "Lighting of High Bay Areas," and "Lighting Outdoor Locations" are now complete.

It is planned that all of these reports shall be in accordance with latest knowledge and practices. However, future progress in the art and science of illumination will doubtless make a revision of these recommendations desirable.

SUBCOMMITTEE ON LIGHTING OF INDOOR LOCATIONS

H. A. Cook, *Chairman*

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COMMITTEE ON LIGHTING OF CENTRAL STATION PROPERTIES

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R. W. Corwin C. B. Stephens
D. W. Taylor

1. Introduction

1.1—*General*—(a) The production of electrical energy involves individual processes integrated into a workable system under one or several roofs and their surrounding outdoor areas. This report deals with lighting the working areas in the generating plant proper and other associated internal spaces.

(b) Many areas, involving various seeing tasks, which may be in any plane from vertical to horizontal and may be viewed for a very short or long time either continuous or intermittent, are contained in these integrated processes. The conditions found in modern power plants may be different from those of the older variety; the conditions may also vary among plants of the same vintage but designed by different groups.

(c) The unique feature of power plant interior lighting is the lack of well delineated areas, and in many instances there are no separating walls or solid ceilings between adjacent areas. In the boiler and heater bay area, for instance, the many levels which would be stories in a building, are in the form of gratings, each connected by open steel stairs. In other areas, the levels are separated by concrete floors and walls, which may be finished or unfinished. Many of the overhead areas are congested with piping and ducts. Lighting must be provided for operation, identification and maintenance.

1.2—*Basis of Report*—(a) Interior lighting in power plants introduces a variety of problems ranging from levels of illumination required only for safety reasons to levels of illumination in offices, such as accounting rooms and instrument repair shops. Since generating stations operate continuously, it is important that adequate and proper lighting be available at all times.

(b) A comprehensive analysis of the fundamentals of good lighting and the special requirements in power generating stations will be made together with a pictorial record of different solutions to typical lighting problems. These data together with the analysis of the lighting problems constitute the body of this report.

2. Seeing Tasks

2.1—*General*—The seeing tasks encountered within the power plant vary widely. The ability to see is primarily dependent upon the level of illumination, the size of the object, the brightness contrast, the absence of objectionable glare and the time available for viewing.

2.1.1—*Size*—As size increases visibility increases and, up to a certain point, seeing becomes easier.

2.1.2—*Brightness*—Brightness resulting from the light on the task and its surroundings in the visual field may be controlled within wide limits by varying the amount and distribution of light. The brightnesses needed for good seeing are usually many times those necessary for mere discernment; with higher brightness one may, to some extent, compensate for deficiencies in size, contrast and time of viewing.

2.1.3—*Contrast*—To be readily visible, each critical detail of the seeing task must differ in brightness (or color) from the surrounding background. Within the limits available to industry, the contrast of seeing tasks, *i.e.*, between the object and its background, should be made as high as possible to reduce the need for much higher illumination levels that would otherwise be necessary.

2.1.4—*Glare*—Glare may be defined as any brightness within the field of vision of such character to cause discomfort, annoyance, interference with vision, eye fatigue, etc. To reduce glare in any lighting application, one feasible expedient is to increase the

Approved by the Council of the Illuminating Engineering Society, April 1957.

TABLE I — Indoor Seeing Tasks and Illumination Recommendations.

Area	Description of Area	Footcandles* Maintained in Service General	Specific	Special Lighting Considerations	Figure Number
Air Conditioning Equipment Room	Area in which heating, cooling and ventilating equipment is located. Not attended.	10	10		2
Air Preheater and Fan Floor	Large enclosed ducts and motors situated in open space near top of boiler. Not attended except for periodic inspection.	10	10	Supplementary lighting should be provided for panel boards. See report titled "Lighting of Control Rooms" for principles to be applied.	3
Ash Sluicing Equipment	Area below boilers. Location of ash hopper and ash pumps. Unattended.	10	10	Vapor-proof units to withstand moist atmosphere.	4
Auditorium	Office type area used for meetings and demonstrations. See current IES "Recommended Practice for Office Lighting."				
Auxiliaries	Distributed about the plant area. Unattended except for periodic inspection. Some equipment may have panel boards on which instruments and gauges are located.	10	20	Supplementary lighting should be provided for panel boards. See report titled "Lighting of Control Rooms" for principles to be applied.	5
Battery Rooms	A ventilated area containing batteries mounted on racks. Unattended but inspected periodically. Readings of specific gravity are taken at regular intervals.	20	20	If walled in, vapor-proof units can be used to retard corrosion.	6, 6a
Boiler Feed Pumps, Tanks, Compressors	Large open area in which boiler feed pumps, tanks, and compressors are located. Not attended except for periodic inspection and reading of gauges on pump panel boards.	10	20	Maintenance on machines in the area will require supplementary lighting. While the panel boards may be equipped with internally illuminated instruments some external lighting on vertical surface is desirable. See report titled "Lighting of Control Rooms" for the principles to be applied.	7
Boiler Gauge Area	Grating platform near top of boiler where boiler water gauge is located. Not attended except for periodic inspections.	10	20	Boiler gauge is internally lighted to make water level easily distinguishable. Area lighting must not throw glare into mirrors used to reflect the gauge image into the control room. Special vertical illumination is also required on boiler gauge if external face of it is televised for transmission to control room receiver.	8
Boiler Platforms	Grating platforms for access to operating and maintenance points of boiler.	10	10		9
Burner Platform	Grating platform giving access to burners whose tips must be cleaned three or four times per week. Not attended except for periodic inspection and during cleaning operations.	10	20 vertical	Vertical illumination is required for inspection and adjustment of the burners; however, if the burner peepholes are televised for transmission to Control Room receivers the illumination should be as low as practicable to insure maximum contrast between peephole brightness and background. Luminaires should not obstruct the outward swing of the burner inspection doors.	10
Cable Room	Located under Control Room. Usually has a very low ceiling height. Cables identified and spread for entrance to control boards above.	10	10		11
Cafeteria and Kitchen	See *IES Lighting Handbook* and report titled "Lighting for Commercial Kitchens."				
Circulator or Pump Bay	On same level as condensers. Devoted to motor driven pumps and auxiliaries. Overhead piping. Superficial attendance.	10	10		12
Coal Conveyor Room	Long narrow area with medium height ceiling. Located at top of coal bunker bay. Houses coal conveyor belt and associated drives. Usually attended when operating.	10	10	Dust tight luminaires, Class II are generally required. (See National Electrical Code.) Supplementary illumination may be provided to determine the level of coal in the bunkers.	13
Coal Crusher	Separate building where primary crushing of coal is accomplished. Also houses conveyor belts.	10	10	Dust tight luminaires, Class II are generally required. (See National Electrical Code.)	14
Coal Feeder and Coal Scale Areas	Automatic machines below bunker feed coal into the pulverizers below. Area is open. Not attended except for periodic inspection.	10	10		15
Coal Pulverizer and Fan Area	Large machines grind coal for firing into boiler by air. Area open and not attended except for periodic inspection.	10	10		16
Coal Transfer Tower	Building located on outdoor coal conveyor system. Houses motors and pullies for conveyor system. Coal transferred from one conveyor belt to another.	10	10	Dust tight luminaires, Class II are generally required. (See National Electrical Code.)	17

*Horizontal except as noted. Supplementary lighting should be provided for maintenance and repairs.

TABLE I — *(Continued).*

Area	Description of Area	Footcandles* Maintained in Service General	Specific	Special Lighting Considerations	Figure Number
Condensers	Located below the main floor of the Turbine Room. Not attended.	10	10		18
Control Room	See report titled "Lighting of Control Rooms."				
Conveyors, Closed	Enclosed coal conveyor and walkway. Periodic inspection.	10	10	In general dust tight luminaires, Class II, are recommended (See National Electrical Code) with distribution characteristics to direct the light over the belts and walk-ways.	19
Deaerator Floor	Grating platform near top of heater bay. Not attended and generally not inspected except when it nears time to repack glands and valves.	10	10		20
Evaporator Floor	Generally near the turbine. It may be on a grating platform. Not attended unless it is necessary to make repairs.	10	10		21
First Aid Room	Office type area. See *IES Lighting Handbook* under hospital emergency rooms.				
Gate House Interior	Location in which visitor and delivery records are kept. Attended.	20	20		22
Heater Floors	Grating platform near top of heater bay. Not attended and generally not inspected except when it nears the time to repack glands and valves.	10	10		23
Hydrogen and Carbon Dioxide Manifold Area	Area in which hydrogen and carbon dioxide bottles and manifold are located with appropriate gauges and meters. Attended only during scavenging and filling process. Unattended at other times except for periodic inspection and recording of gauge readings.	10	20	Hazardous area. Luminaires should be used in accordance with the National Electrical Code.	24
Instrument Repair Shop	Area with work benches where meters and test equipment are maintained and repaired.	50	50	Localized lighting is necessary for some applications.	25
Laboratory, Chemical	Office type area with stationary laboratory tables, some of which are hooded. Water, oil, coal and gas test are performed.	50	50	Color improved fluorescent lamps are often used for good color rendition.	26
Locker and Wash Rooms	See "American Standard Practice for Industrial Lighting."				
Offices	See Current IES "Recommended Practice for Office Lighting."				
Oil Storage Rooms	Closed area for storage of oil generally in drums.	10	10		
Precipitators	Large enclosed dust tight area usually located on the roof. Not attended except for scheduled inspections.	10	10		
Screen House	Location of rotating screens and rakes. Periodically cleaned with water hose. See report titled "Lighting of Central Station High Bay Areas."	10	20	Localized lighting for trash rake. Vapor-proof luminaires to withstand water spray during cleaning.	
Shops — Carpentry, Machine, Paint	See "American Standard Practice for Industrial Lighting."				
Soot or Slag Blower Platform	Grating platform near top of the boiler. Location of soot or slag blowers for cleaning inside of boiler. Unattended except for periodic inspections and maintenance.	10	10	Luminaires should be placed as near as possible to access doors on face of boiler.	27
Stairways	Usually open type. Platforms may be grating type.	10	10		28
Steam Headers and Throttles	Area where main steam throttle valves are located. Unattended.	10	10		29
Stock Rooms	Small parts stored in bins. Attended.	20	20	Luminaires should be selected so that continuous illumination is provided along full length of bins. It is desirable to paint the inside of the bins with a high reflectance paint.	30
Storage Rooms	Large open areas. Large equipment stored and stacked on floor.	10	20		31
Switchgear, Power	Oil or air switches enclosed in steel cubicles on the face of which may be located starting and stopping buttons and miscellaneous meters. Cubicles may be located in open parts of the plant. Periodic inspection.	10	20	See report titled "Lighting of Control Rooms" for principles to be applied to lighting cubicle face.	32
Telephone Equipment Room	Location of telephone racks. Unattended but regularly maintained. Usually an enclosed room.	20	20		33

*Horizontal except as noted. Supplementary lighting should be provided for maintenance and repairs.

TABLE I — *(Continued).*

Area	Description of Area	Footcandles* Maintained in Service General	Specific	Special Lighting Considerations	Figure Number
Tunnels or Galleries, Piping	Corridor type areas in which piping is located along the ceiling or walls. Not attended, but periodically inspected.	10	10		34
Turbine Bay Sub-basement	Large open area containing miscellaneous pumps, oil storage tanks, valves, and switch cubicles. Unattended except for periodic inspection.	10	20		35
Turbine Room	See report titled "Lighting of Central Station High Bay Areas."				
Visitor's Gallery	Usually a sound proof room from which visitors can observe the turbine room through glass windows.	20	20	Luminaires should be located to minimize annoying reflections in the glass windows.	
Water Treating Area	Open area which is not attended except for periodic inspection. Associated panel boards with gauges and instruments and switch cubicles may be located here. Some simple tests may be conducted here instead of taking the samples to the laboratory.	10	20	For panel board illumination see report titled "Lighting of Control Rooms" for principles to be applied.	36

*Horizontal except as noted. Supplementary lighting should be provided for maintenance and repairs.

angle between the glare source and the line of vision by mounting the luminaire as high as practicable. The most usual way to control glare is to select luminaires which have large shielding angles and, therefore, reduced brightness.

2.1.5—*Time of Viewing*—By increasing illumination the time required for seeing will be shortened. The eye requires time to adjust to different brightnesses and, therefore, in the interest of safety and of expediting work, associated areas must not have great brightness differences.

3. Typical Indoor Lighting in Central Station Areas

3.1—***General***—**(a)** The purpose of this section is to cover in a general way typical situations that are common to Central Station areas and to illustrate various methods that have been found satisfactory in lighting them. Table I gives in alphabetical order a description of the typical areas, the recommended illumination levels, and special lighting considerations for these areas where required.

(b) In Table I the footcandle levels recommended are shown in two columns headed *General* and *Specific*. These headings are defined as follows:

(1) General — The average level of illumination for the entire area.

(2) Specific — The level of illumination required for operation or maintenance at important locations in the area.

(c) In most cases properly locating the luminaires used to secure the general level of illumination will provide the specific recommended level of illumination.

3.2—***Illumination Levels***—The illumination levels specified in Table I are based on the study of current satisfactory practice. The values recommended are for the illumination on the working plane of each area whether it is horizontal, vertical, or otherwise for routine operating conditions. It is to be expected that the quantity of illumination will often vary widely and that the average footcandle reading is not a true indication of the effectiveness of the installation. Supplementary lighting should be provided for maintenance and repairs.

4. Factors Controlling Illumination and Lighting Systems

4.1—***General***—Many factors must be considered in designing indoor lighting systems such as: the type of luminaires available, which includes their lighting distribution characteristics, their ability to withstand the ambient temperature conditions, their features that facilitate in maintenance and their mounting requirements; the light sources available; the desired illumination levels; the need for emergency lighting; maintenance; and the location of luminaires to minimize glare and shadows.

4.2—***Luminaires***—**(a)** A wide range of lighting equipment is available, most of which finds some application around the plant, but none of which is adaptable for all purposes. Two groups of lighting units are generally used for these indoor lighting applications. These are (1) Industrial Luminaires (including suspension and bracket mounted types, open or enclosed) and (2) Office Lighting Luminaires (including suspension, surface, and recessed types).

(b) In choosing the type best suited for the purpose at hand, consideration must be given to: the pattern of light distribution; any tendency to cause objectionable glare under normal conditions; the mechanical construction and convenience of servicing; the overall suitability of the unit for the application; and whether or not the area is classified as hazardous.

4.2.1—*Industrial Luminaires*—**(a)** Industrial luminaires with direct and semi-direct distributions are most commonly used. These utilize such control media as porcelain-enamel, baked enamel, processed aluminum, mirrored glass, prismatic glass, and plastic.

(b) Industrial luminaires are classified according to the distribution of their direct component of light. These classifications, which vary from Highly Concentrating to Wide Spread, and the corresponding Spacing-to-Mounting Height Ratio (above work plane) are shown in Table II. To determine a luminaire's classification and the Spacing-to-Mounting Height Ratio (see Fig. 1). Where a large portion of the working plane is vertical or nearly so, the "Spread" types are generally used.

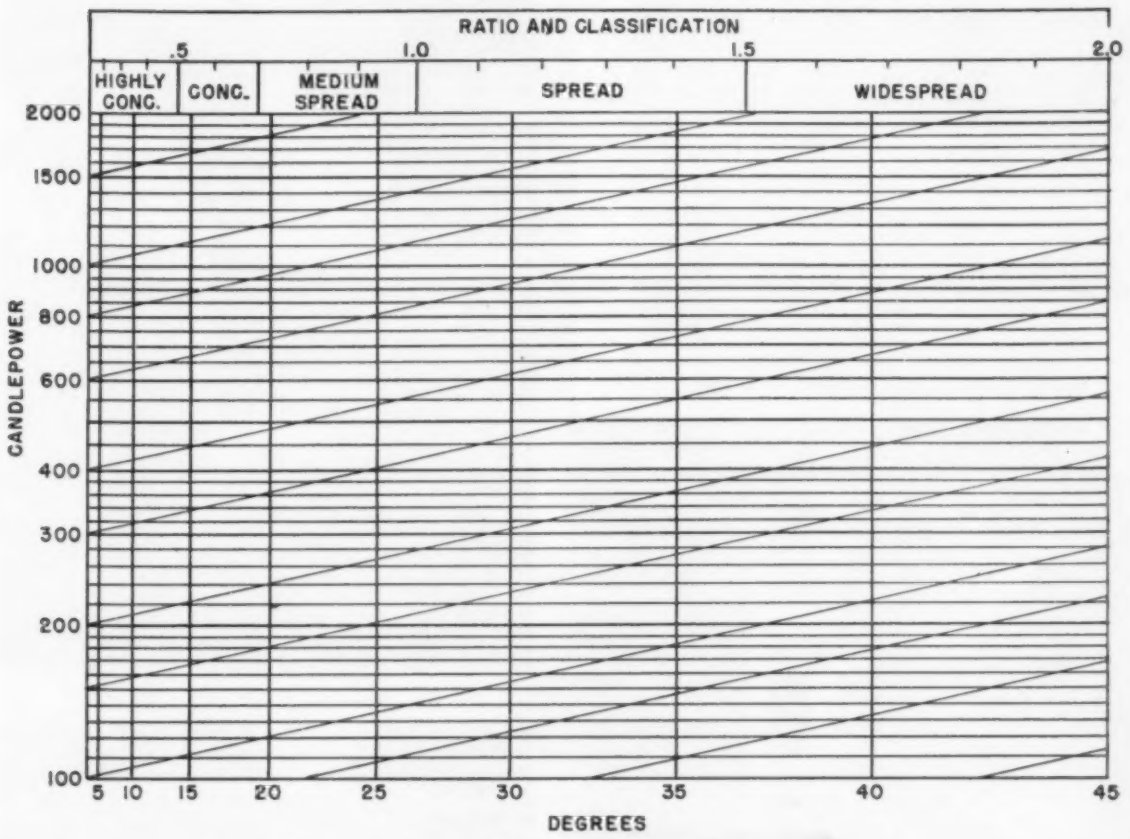


Figure 1. Spacing-to-Mounting Height Ratio Chart. Directions for use are:

(a) Plot the photometric curve in rectangular coordinates on the chart;

(b) smooth out any pronounced irregularities in the curve;

(c) on the left vertical edge of the chart take a point at one-half the candlepower at zero degrees and draw a line from this point parallel to the diagonal lines;

(d) from the point at which this diagonal line crosses the photometric curve (as plotted on the chart), follow a vertical line up to the top of the chart and read the spacing-height ratio and distribution classification.

The "Concentrating" types are generally used at mounting heights equal to or greater than the width of the room if the surfaces to be lighted are predominately horizontal.

(c) When reflectorized lamps are used, they should be supplied with housings to provide protection against water and falling objects and to shield against direct glare.

(d) For further reference see "American Standard Practice for Industrial Lighting."

4.2.2—*Office Luminaires*—Luminaires for offices are in five classifications designated as indirect, semi-indirect, general diffuse (direct-indirect), semi-direct, or direct. For selection of the proper luminaire, refer to the IES "Recommended Practice for Office Lighting."

4.3—***Light Sources*** — **(a)** Several types of light sources may be used in the luminaires. A wide range of spectral characteristics is available in these various sources.

(b) Incandescent lamps because of their simplicity, dependability and range of styles and sizes are widely used for many of these applications.

(c) Mercury lamps are also used for general lighting and have an advantage in having higher efficiency than incandescent lamps.

(d) Fluorescent lamps are used because of their high efficiency and relatively low brightness.

(e) Table III lists some of the advantages, disadvantages, and characteristics of each of these sources which determine to a great extent their suitability for various applications.

TABLE II — Classification by Distribution in Terms of Permissible Spacing-to-Mounting Height Ratios.

Spacing-to-Mounting Height Ratio (Above Work Plane)	Luminaire Classification
Up to 0.5	Highly Concentrating
0.5 to 0.7	Concentrating
0.7 to 1.0	Medium Spread
1.0 to 1.5	Spread
Over 1.5	Wide Spread

4.4—***Emergency Lighting*** — **(a)** In the event of a failure in the normal lighting supply, enough illumination should be provided by emergency means for personnel to operate important controls and to enable personnel to leave the building. Such areas where this illumination is essential, are

(Text continued on page 438)

Some Indoor Locations Of Central Station Properties

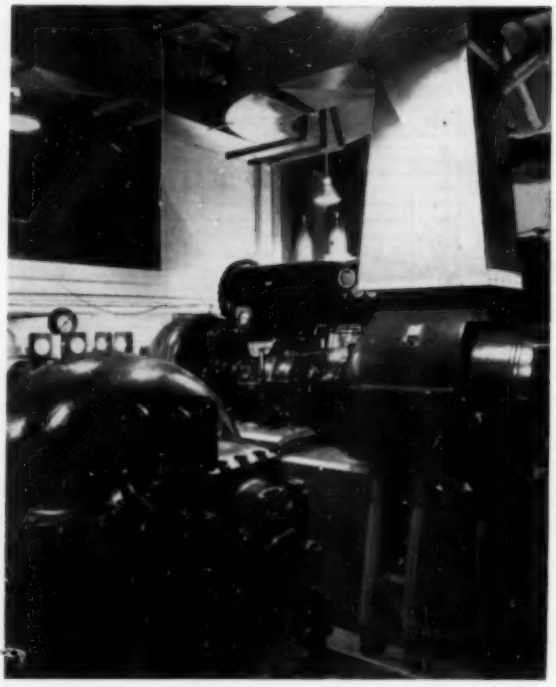


Figure 2 (right). Air conditioning room.

Figure 3 (below). Air preheater and fan floor.

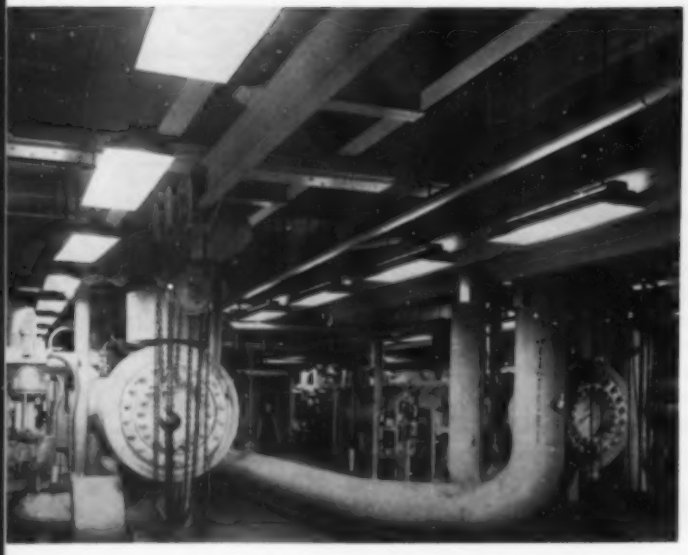
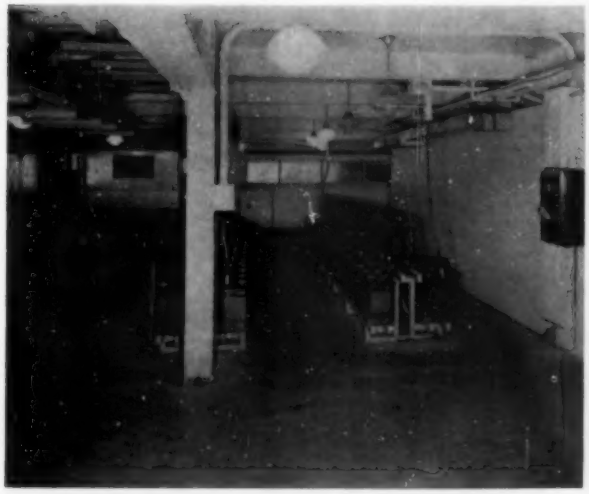


Figure 4 (above). Ash sluicing equipment.

Figure 5 (left). Auxiliary bay area.



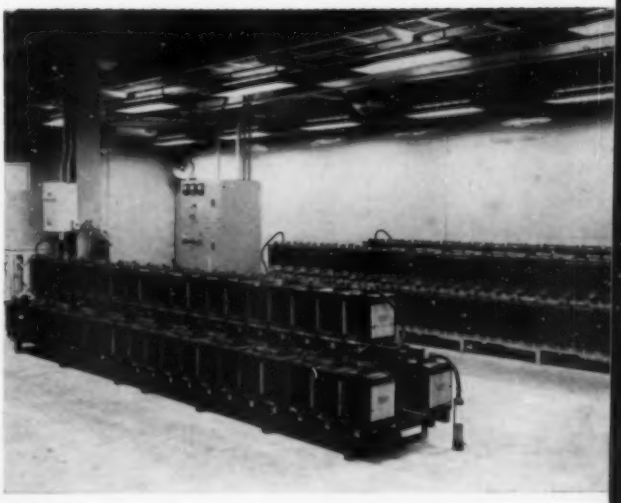


Figure 6. Battery rooms.

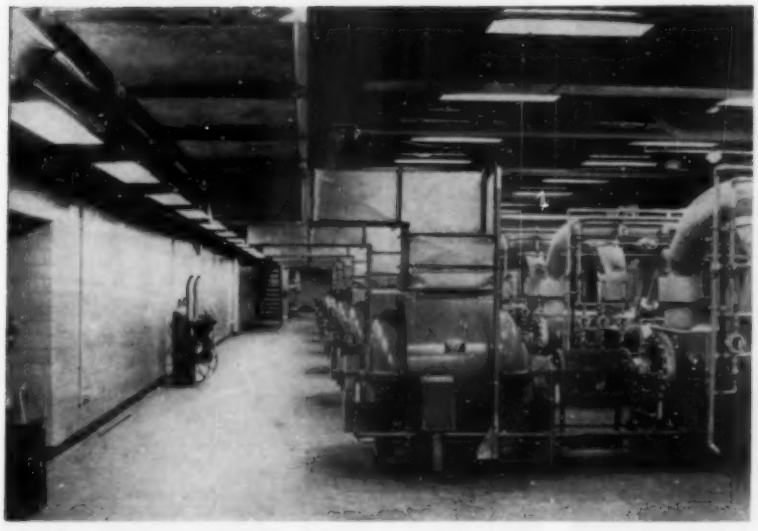


Figure 7. Boiler feed pump area.

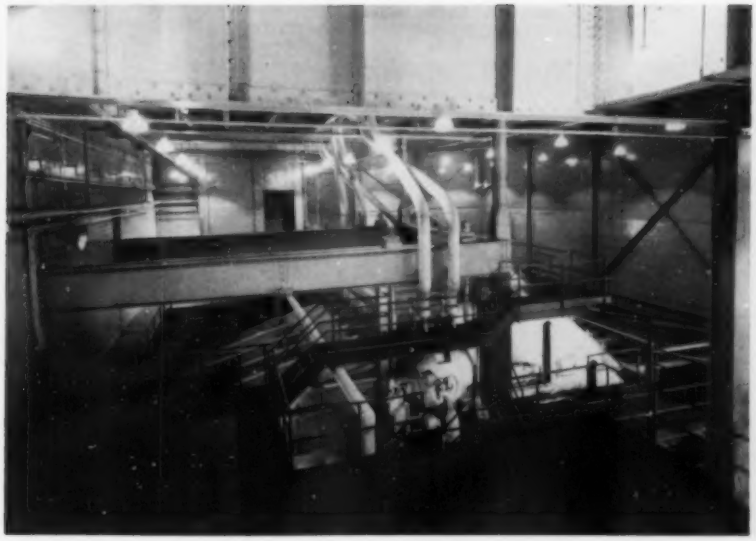


Figure 8. Boiler gauge area.

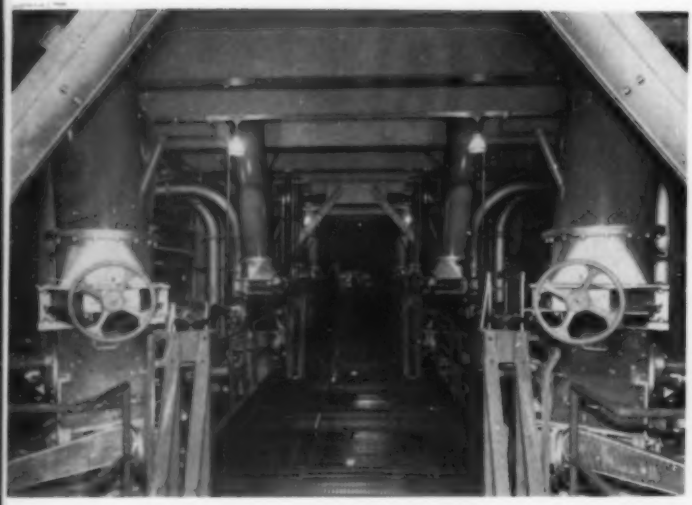


Figure 9. Boiler platform.

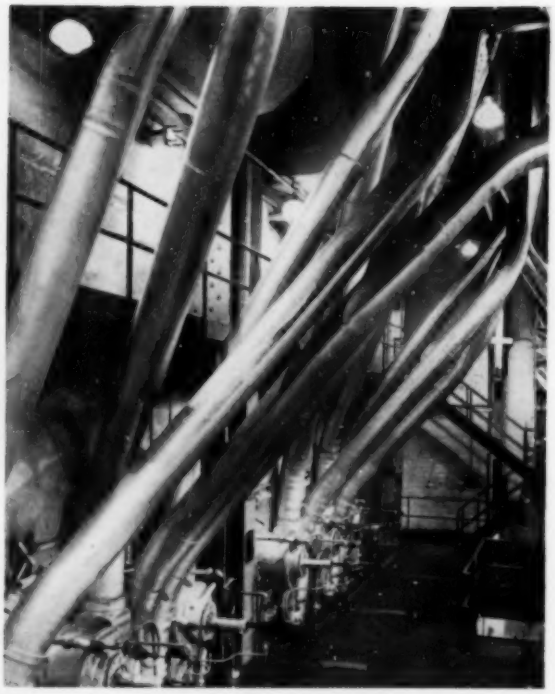


Figure 10. Burner platform.

Figure 11. Cable room.

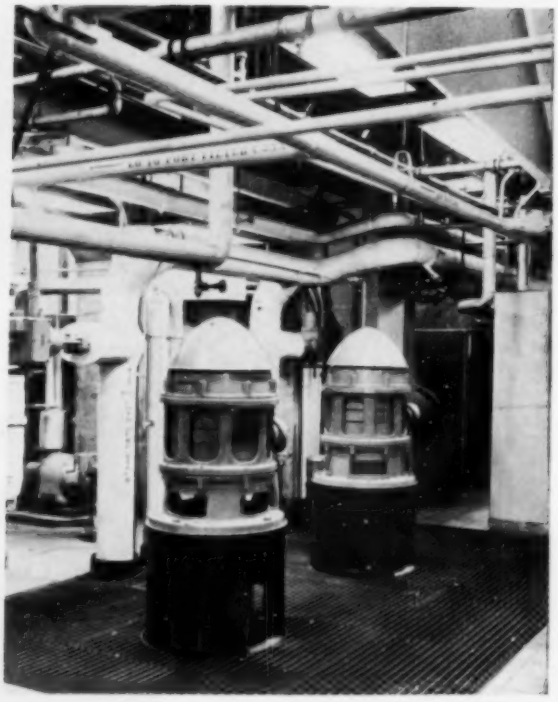


Figure 12. Pump bay.

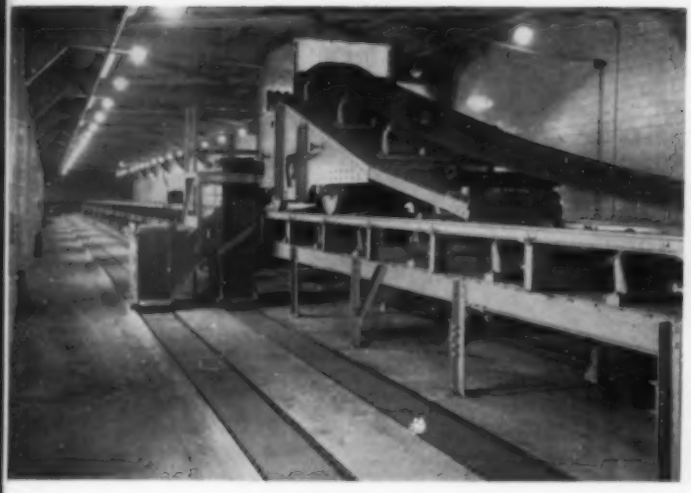


Figure 13 (left). Coal conveyor room.

Some Indoor Locations Of Central Station Properties

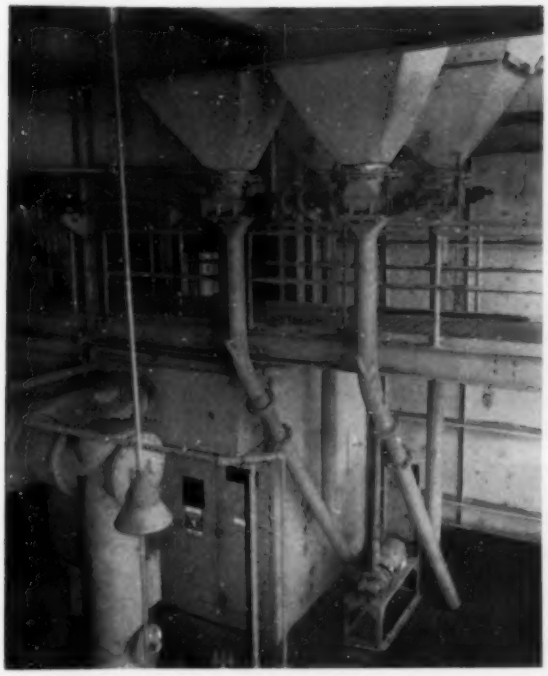


Figure 14. Coal crusher area.

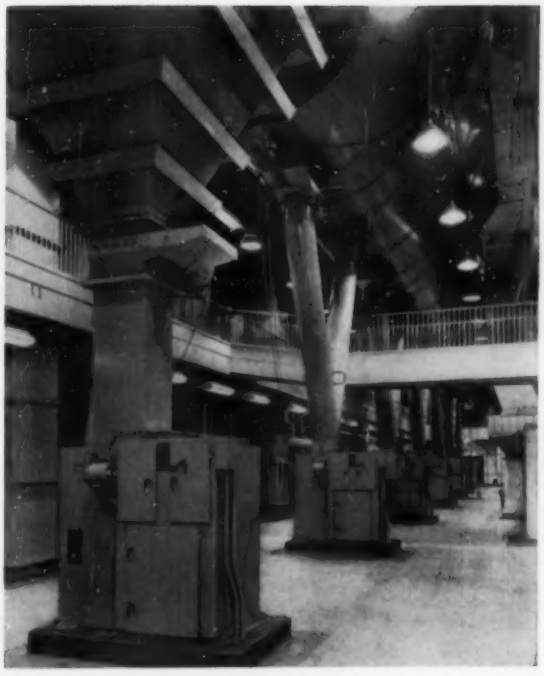


Figure 15. Coal feeder area.

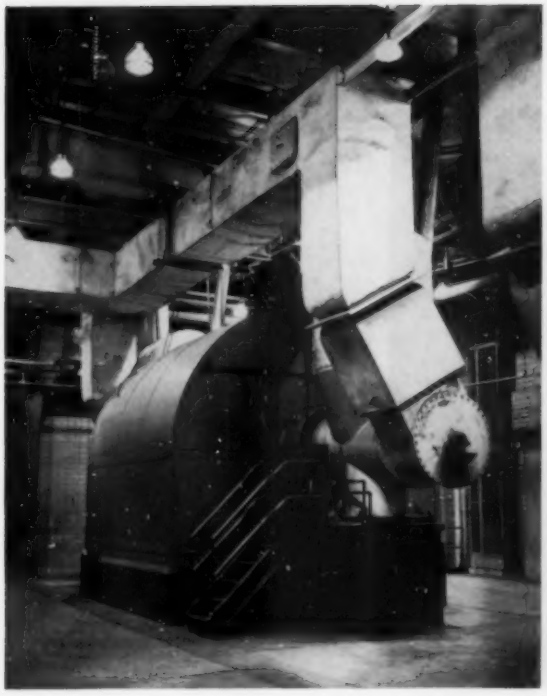
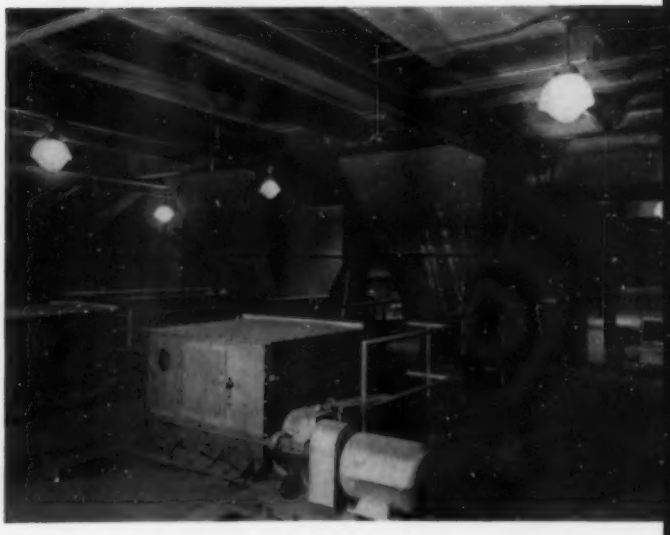


Figure 16 (left). Coal pulverizer area.

Figure 17 (below). Coal transfer area.



Some Indoor Locations Of Central Station Properties

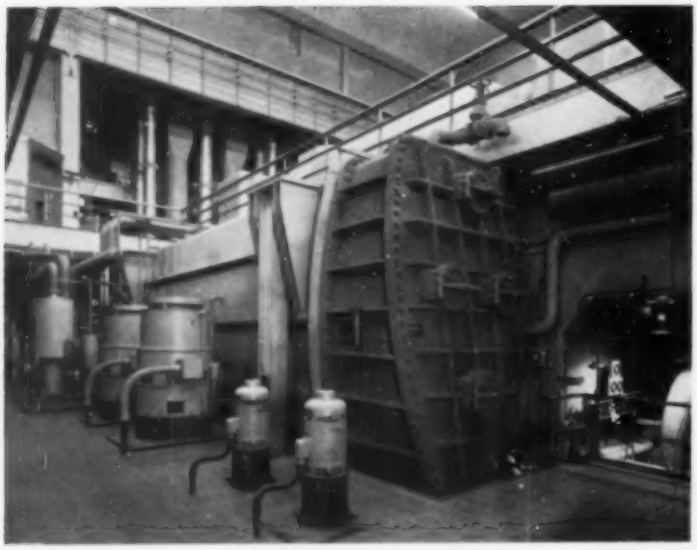


Figure 18. Condenser area.

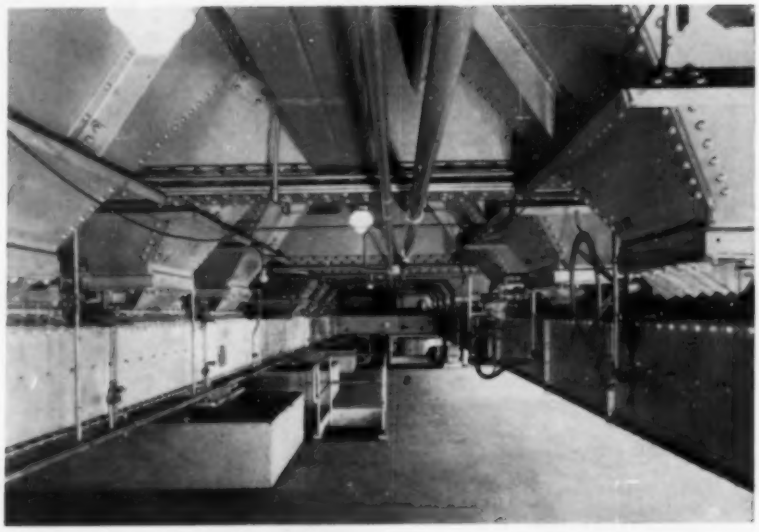


Figure 19. Closed conveyor.

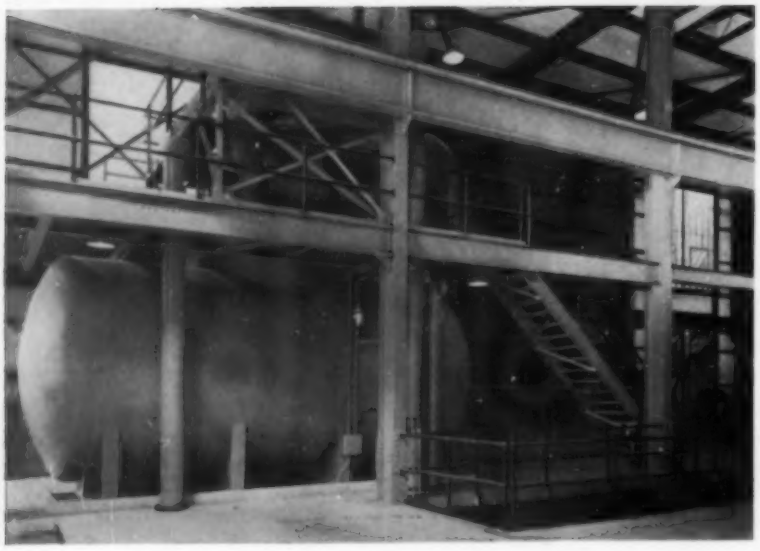


Figure 20. Deaerator floor.

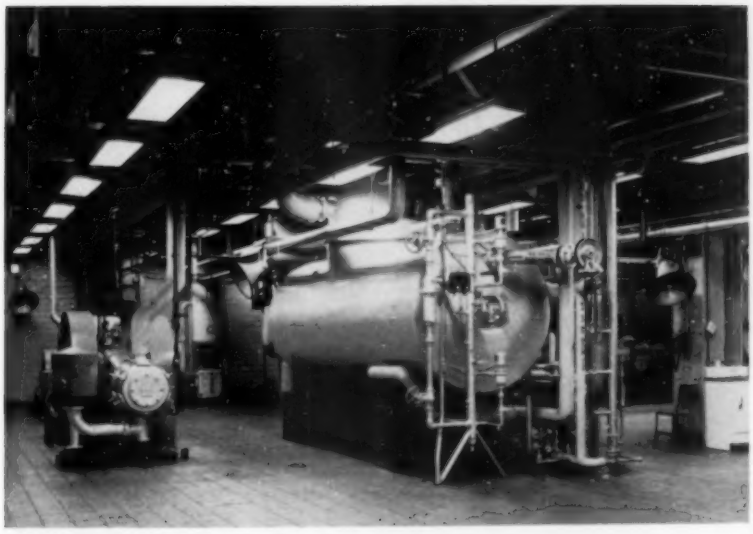


Figure 21. Evaporator floor.

Figure 22. Gate house interior.

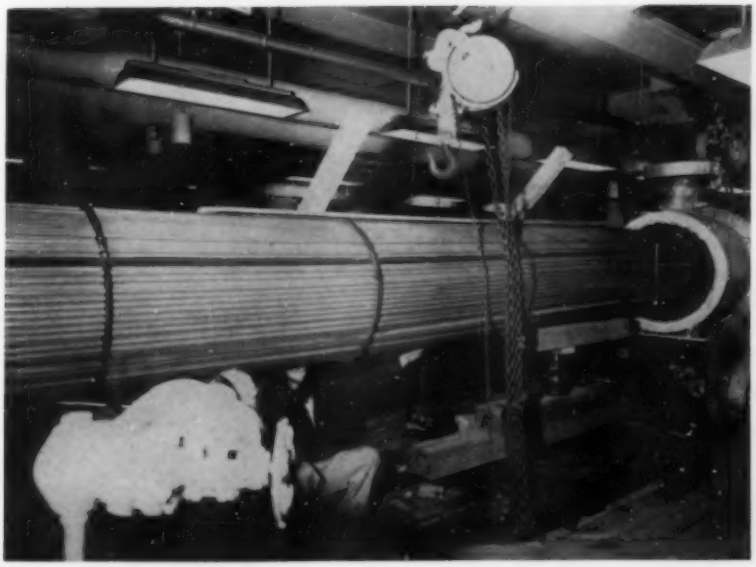
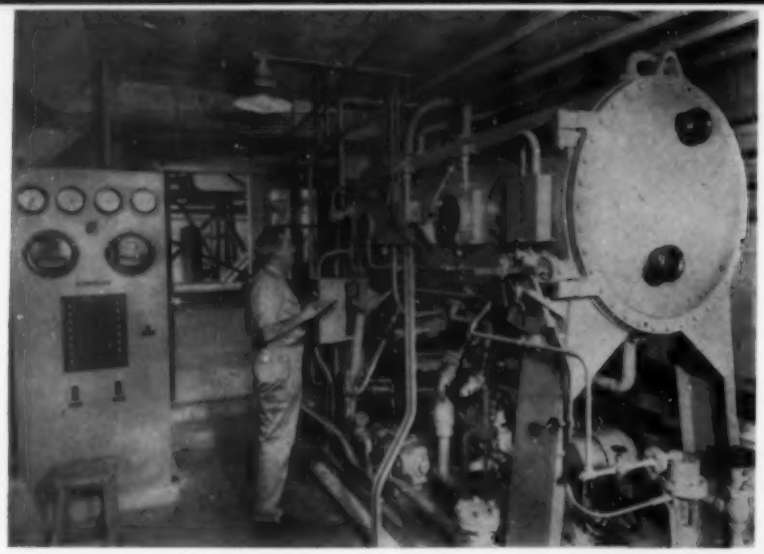


Figure 23. Heater floor.



Some Indoor Locations
Of Central Station Properties

Figure 24 (above). Hydrogen area.

Figure 25 (right). Instrument repair shop.

Figure 26. Chemical laboratory.

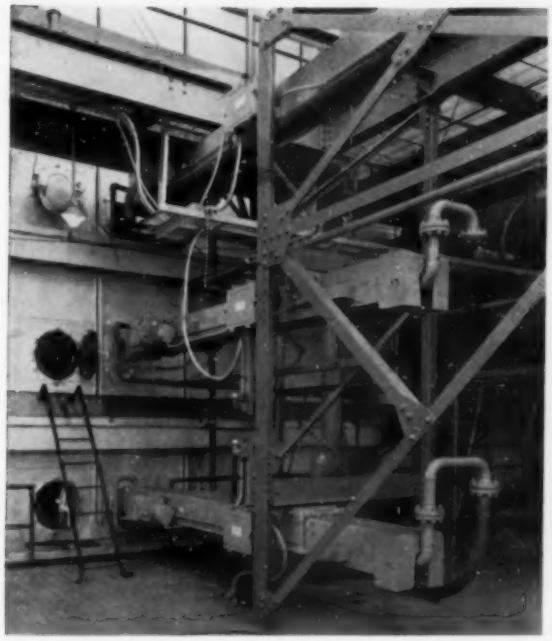


Figure 27. Soot blower platform.

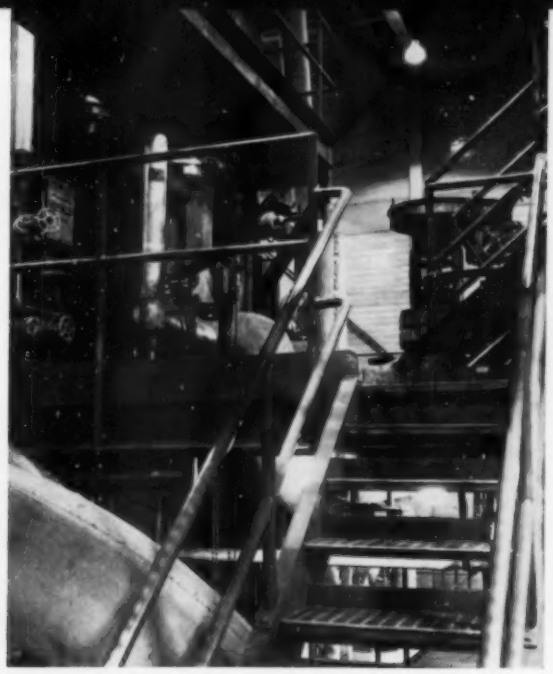


Figure 28. Typical stairway.

Figure 29 (right). Steam header area.

Figure 30. Stock room.

Some Indoor Locations Of Central Station Properties

Figure 31. Storage room.

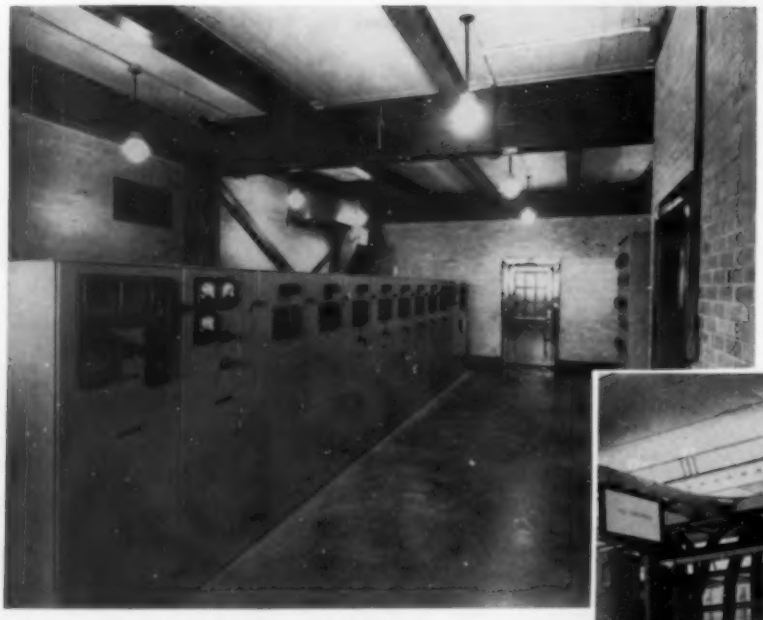


Figure 32 (above). Switchgear cubicle area.

Figure 33 (right). Telephone equipment room.

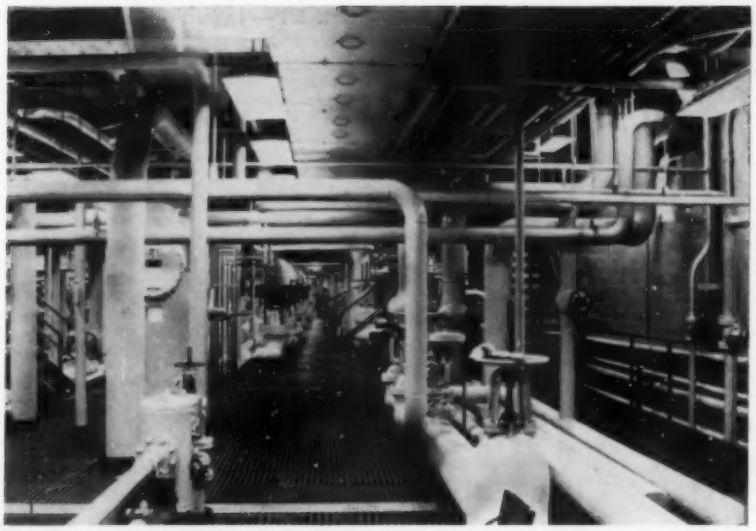


Figure 34. Pipe gallery.

Figure 35. Turbine bay sub-basement.

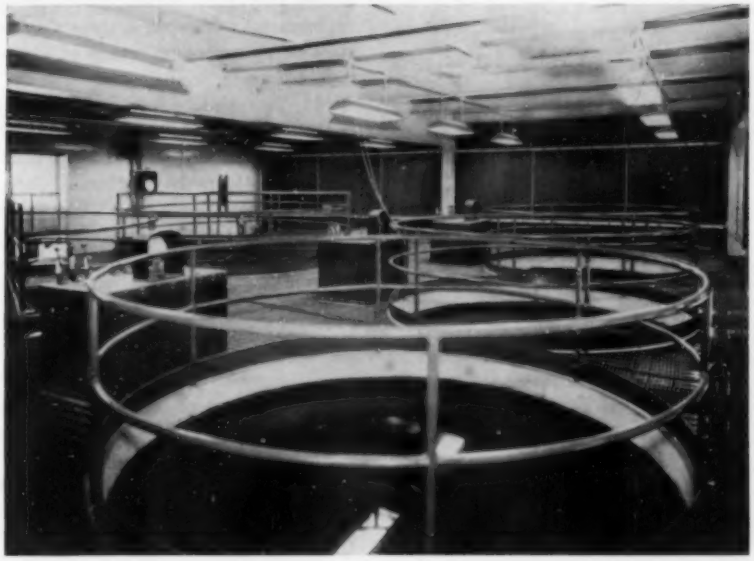


Figure 36. Water treating area.

TABLE III — Light Source Characteristics.

Lamp Type	Advantages	Disadvantages	Electrical Characteristics
Incandescent	Available in a wide variety of sizes and wattage and voltage ratings. No auxiliary equipment need for lamp operation. Small source well suited to light control by an external reflector or a reflector on the inside of the bulb. Light output little affected by ambient temperature. Operates equally well on alternating or direct current. Provides lighting at a comparatively low initial cost. Various wattage lamps interchangeable within many luminaire designs. High maintenance of light output throughout life.	Low luminous efficiency. (Lumens per watt input approx. ⅓ that of mercury or fluorescent lamps.) Short life. High brightness source. Not well suited to shock and vibration conditions especially in the high voltage designs unless special lamp construction is used.	Lamp life and light output strongly affected by voltage variations.
Mercury	High luminous efficiency. Good resistance to shock and vibration. Available in many sizes and wattages. Long life. Good maintenance of light output throughout rated life.	High brightness of source. Requires several minutes to come up to full output. Requires a transformer for lamp operation. Lamp life shortened by number of starts. Operation practical only on alternating current. Lamps may go out due to sudden voltage dips and then require several minutes to restart.	Life and light output affected by voltage variations.
Fluorescent	High luminous efficiency. Low lamp brightness. Linear source reduces shadows. Available in many sizes and wattages. Long life. Good maintenance of light output throughout life. Good resistance to shock and vibration.	Low light output per lamp requires more luminaires. Ballast required for lamp operation. Life of hot-cathode lamps shortened by number of starts. High initial cost. Operation practical only on alternating current. Long lamps difficult to handle. Difficult starting and low lumen output at low temperatures unless equipment designed for low temperature operation is used.	Life and light output affected by voltage variations.

(*Text continued from page 427*)

Control Rooms, Turbine Rooms and exit stairs and passageways.

(b) When the normal supply fails, a number of luminaires in each of the above areas is connected by means of a transfer system to an alternate supply — the number of luminaires depending on the capacity of the alternate supply. This new supply can be provided by storage batteries, engine-generator sets or from a remote normal lighting source which has not failed. Because the latter is not dependable, a storage battery or engine-generator supply should always be provided and connected during emergency conditions.

(c) Whenever possible, Wide Spread low wattage luminaires should be utilized for the emergency lighting to give maximum coverage with minimum load.

4.5—*Maintenance* — **(a)** The rate of depreciation of lighting equipment is dependent upon the atmospheric conditions and the type of equipment employed. One method of establishing a suitable maintenance schedule for cleaning is to check the illumination periodically with a light meter. When the illumination has decreased to two-thirds of its initial value, the lighting equipment should be cleaned. A thorough cleaning of lighting equipment, at least twice a year, is justified in most locations. In dirtier areas, more frequent cleaning is economically justified.

(b) Dirt collection on ceilings and walls also results in loss of light. Periodic cleaning and repainting of these surfaces is required to increase the maintained lighting level, as well as to improve the appearance and comfort of the area.

(c) The output of all light sources diminishes with use and, in many cases, it is economical to replace lamps before they fail. With planned lamp replacement schedules, savings may be realized by replacing groups of lamps rather than individual ones.

(d) To facilitate cleaning and lamp replacement, a wide variety of maintenance equipment, such as extension ladders, adjustable platforms, lamp changers, scaffolding, and other types of specialized equipment is available. Selection of the proper equipment substantially reduces the time and expense involved in maintaining the lighting equipment.

(e) Important factors to consider in the selection of lighting equipment are the rate of dirt collection and the ease of cleaning. The open-bottom type has the advantage of no bottom surface to collect dirt and dust. Closed-bottom units of the dust-tight variety are often used to prevent dirt accumulation on the lamps and reflecting surfaces. Considerable care must be exercised during the relamping to insure adequate sealing against dust as a very small defect in gasketing will allow the luminaire to breathe in dirt. Tests on open type units indicate that dirt accumulates at a lower rate in units designed with ventilating areas at the top of the unit. With this construction, the air movement through the unit tends to carry air-borne dirt through the luminaire, rather than depositing it on the reflector and lamp.

I.E.S. National Technical Conference

Atlanta, Georgia

September 9-13

A.I.A. File No. 31-f

INSTALLATION AT PHILADELPHIA ELECTRIC CO.
211 SOUTH BROAD ST., PHILADELPHIA, PA.

Lighting a Reception Area

LIGHTING OBJECTIVE: To provide pleasant general illumination for a reception area in an office building.

GENERAL INFORMATION: This area is 21 feet long, 12 feet wide and 9 feet high. Colors and reflectances are as follows:

ceiling	white	62% RF
walls	green	40% RF
floor	gray	22% RF
wood furniture	walnut	6% RF
couch	green	9% RF

INSTALLATION: Nine Skylike Lighting, Inc., catalogue No. RP 50F/150 recessed units provide an average illumination level of 28 footcandles. These 24-inch square egg-crate louvered units each contain one 150-watt PS-25 silvered bowl inside frosted lamp. The resultant brightness pattern is indicated below:

ceiling	4.4 ft-L	desk	0.5 ft-L
walls	4.0 ft-L	couch	0.7 ft-L
floor	5.6 ft-L	luminaire at 45 degrees	63 ft-L

Supplementary lighting at reading positions is provided by Certified table lamps.

Lighting designed by C. W. Rudolph, Philadelphia Electric Co., Philadelphia, Pa.

Lighting data submitted by George T. Anderson, Jr., Philadelphia Electric Co., Philadelphia, Pa., as an illustration of good lighting practice and to aid in the design of similar installations.

Published by the Committee on Publications of the Illuminating Engineering Society, 1860 Broadway, New York 23, N. Y.

Series XXII 8-57

A.I.A. File No. 31-f

Here and There With MMILJ Contestants

MICHIGAN SECTION. Residential division (left) First place winner Gertrude Urbank accepts certificate from contest chairman Leonard Gussow. Commercial division (right). Top winner Lawrence T. Genise is congratulated by Mr. Gussow.

ARIZONA SECTION. Commercial division winner Don Roberts with contest judges: left to right, J. D. Whitnell, Mr. Roberts, Paul Young and Archie Brown.

ARIZONA SECTION. Residential division—Bill Downey, 3rd place; Bill Hinckley, 2nd place; Jack Mulsow, program chairman; and Les Waggoner, 1st place winner.

NEW ORLEANS SECTION. Commercial division (below). Harbert S. Gregory, first prize winner, with Section Chairman E. C. Berdon. In the Residential division, Mrs. Edna Fortier took top honors.

GOLDEN GATE SECTION. Left to right, John Epperson and W. P. Mazzetti, 2nd prize; Warren Smith and Ted Ciampi (kneeling), 1st prize; James Delos, 4th prize; Harvey Christensen, 3rd prize.

LIGHTING NEWS

Professor John O. Kraehenbuehl Awarded I.E.S. Gold Medal

John O. Kraehenbuehl

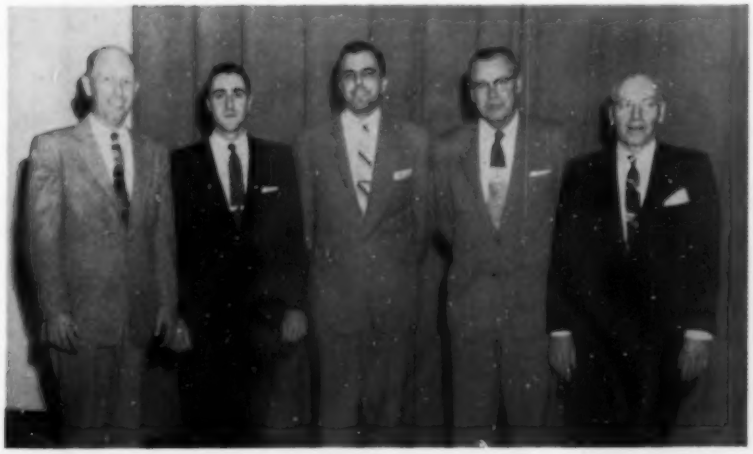
With the unanimous approval of Council, and certainly with the hearty endorsement of the entire Society, the I.E.S. Gold Medal and certificate, highest honor in the field of illumination, has been awarded to John O. Kraehenbuehl, Emeritus Professor, University of Illinois, Urbana, Illinois. Formal presentation of this top I.E.S. award will be made to Prof. Kraehenbuehl during ceremonies to be held at the National Technical Conference in Atlanta next month.

Prof. Kraehenbuehl's outstanding contributions to illuminating engineering cover many fields — education, literature, industry, Society activities, research and application engineering. It would be difficult to say in which area his work is more distinguished. Probably best known is his success in illuminating engineering education, his text book *Electrical Illumination* and his participation in lighting research. He is, however, almost equally renowned through his consulting work, numerous published papers and books, and his valuable association as chairman and member with some twenty I.E.S. committees. The nature of his unselfish devotion to I.E.S. activities is exemplified by the fact that it was carried out entirely at his own personal expense.

One of Prof. Kraehenbuehl's most conspicuous achievements was the creation and direction of a fully-integrated Illuminating Engineering Option at the University of Illinois. This has been a unique comprehensive academic program, productive of a very large number of graduates having a broad professional training for this field. After teaching lighting courses for many years and building up extensive laboratory and demonstration facilities, Prof. Kraehenbuehl succeeded in 1945 in establishing the comprehensive Option. Starting with the 1948 graduates, approximately 152 degrees have been granted, including 15 Masters and one Doctor. A required lighting course for sophomores in electrical engineering served as orientation and resulted in bringing into the Option students of high caliber, who upon graduation quickly demonstrated their ability and well-rounded training. A notably high percentage have not only continued in a lighting career but have achieved distinction and honor themselves. In one recent year (1955) it is interesting to note that nine papers and articles by alumni of the Illinois Option appeared in ILLUMINATING ENGINEERING.

Far-reaching in its effects also, was the professor's lighting course for the students of the School of Architecture at Illinois. In the 1930's, during the ten years of the nation-wide I.E.S. Competition administered by the Beaux Arts Institute of Design, the University of Illinois entrants year after year won a major part of the prize-money — a tribute, among other things, to the stimulating effective teaching of Prof. Kraehenbuehl.

Prof. Kraehenbuehl's published works include three widely accepted text books on illumination and advanced lighting calculations, and over 40 papers on illumination and electrical engineering sub-



PHILADELPHIA SECTION. MMILJ winners are, left to right, W. R. Mackinney, Section Chairman; S. W. Purdum, 2nd prize; G. C. Linthicum, 1st prize; C. A. Holm, 3rd; W. P. Graham, Chairman of the contest.

Address Changes should be reported to I.E.S. Headquarters by the first of any month, to insure the uninterrupted mailing of I.E. and other Society communications.

jects. His I.E.S. activities, in addition to his contributions to ILLUMINATING ENGINEERING, cover 20 years of outstanding contribution. He organized and sponsored the first Student Chapter of I.E.S. Particularly valuable also has been his work with the I.E.S. Research program, and with the many national committees of which he has been member and/or chairman. In recognition of his contributions to illuminating engineering Prof. Kraehenbuehl was elected Fellow of I.E.S. in 1948.

Associated for 34 years with the University of Illinois, Professor Kraehenbuehl was named Emeritus Professor in 1956, and is currently engaged in developing pre-engineering curriculum at Colorado College, Colorado Springs.

Fog Lighting Research Results Demonstrated

Rather far-reaching changes in future roadway and automobile headlighting illumination have been indicated by recent researches in fog-lighting techniques. At a meeting, held specially for the purpose June 28 at Pennsylvania State University, results were demonstrated of two research studies on the effect of fog on highway illumination. Both these researches are projects of the Illuminating Engineering Research Institute and have been conducted under its auspices by Prof. C. R. Marsh at Pennsylvania State, University Park, Pa., Dr. R. H. Blackwell, professor of psychology and director of the Vision Research Laboratory at the University of Michigan, Ann Arbor, and Benjamin S. Pritchard, professor at the Willow Run Research Center, Ann Arbor. Professor Marsh and Dr. Blackwell head two phases of the fog-illumination project undertaken in 1953 by the Illuminating Engineering Research Institute at the request of turnpike authorities in an effort to reduce the number of fatal and near-fatal accidents on fog-shrouded highways. Also participating in the demonstration were Dr. M. A. Williamson, Dean of Engineering and Architecture, Penn State, and General W. W. Wanamaker, Executive Director of the New Jersey Turnpike Authority.

Results of the studies indicate, according to Prof. Marsh, that it will be possible to increase visibility in fog on the open highway by 100 per cent or even

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I.E. Wins Merit Award For Editorial Excellence

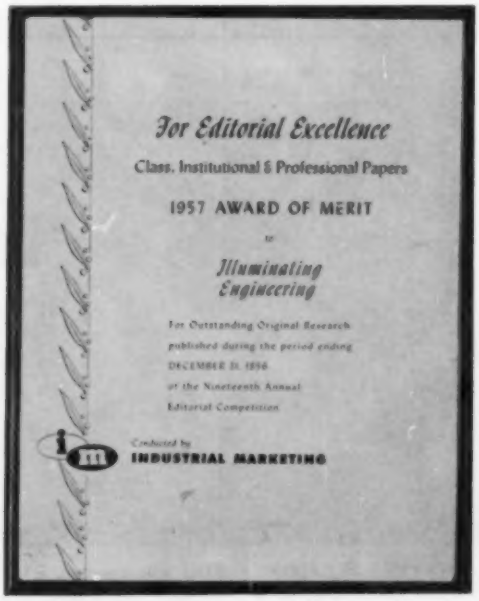
In an article titled "Fifty-four Business Papers Show What It Takes To Be Tops," the June 1957 issue of *Industrial Marketing* (business paper for magazines) announced the results of its Nineteenth Annual Competition for Editorial Achievement. Prominent amongst the 54 winners, out of 653 entries, was the Society's journal ILLUMINATING ENGINEERING. Winning feature in the class Institutional and Professional Papers, in the judgment of 31 distinguished judges, was "Fifty Years of Significant Developments in Lighting" published in the January 1956 issue of I.E.

A framed certificate Award of Merit for Editorial Excellence was presented to Ruby Redford, editor of I.E., at presentation ceremonies held June 10 at the Waldorf-Astoria Hotel, New York, N. Y.

The competition, designed to recognize and stimulate outstanding editorial accomplishment by professional and business magazines, is conducted annually by *Industrial Marketing*. Its stature, and the importance of its awards attracts literally hundreds of entries each year, magazines from all fields vying for the honor of being judged Best in Editorial Achievement. Fifteen first award plaques and 30 certificates of merit are offered each year in three broad fields of business paper service: Industrial; Merchandising, Trade and Export; and Institutional and Professional. This year's competition had a record 653 entries in the various classes.

In addition to ILLUMINATING ENGINEERING, other winners of "Best Original Research" in the professional magazine class, were *School Executive* (plaque) and *Progressive Architecture* (award of merit certificate).

I.E. Editor, Miss Ruby Redford, is presented with ...



... Certificate for Editorial Excellence.

more through light control within the next year. The demonstration, in which Prof. Marsh participated, showed that changing the mounting angles of highway lighting, using low-mounted white fog lights, and polarizing the light sources can successfully accomplish a major improvement in visibility in fog. Three separate types of light control were exhibited, each producing a notable although varying effect in penetrating a controlled fog barrier.

The demonstration at Penn State was attended by some 50 turnpike authorities from ten states, highway safety experts and street lighting engineers. Complete results of this important fog-lighting research will be presented in a paper to be presented before the Society at the National Technical Conference of I.E.S. in Atlanta next month.

Palmetto Chapter Gets Section Charter

A transfer to Section status was approved at the Council meeting June 12 for the Palmetto Chapter, located in Greenville, S. C. The action was taken on recommendation of J. D. Mitchell, Vice-President, Southeastern Region. The Palmetto group received its original Charter in June 1954 and has grown rapidly since that date in number and stature.

Committee Reports Approved

Four technical committee reports approved through letter ballot reported at the June 1957 Council meeting are:

1. Testing Procedures Committee Report — "IES Guide for Photometric Measurements of Fluorescent Lamps."
2. Testing Procedures Committee Report — "IES Guide for Photometric Testing of Outdoor Fluorescent Luminaires."
3. Daylighting Committee — "Proposed Guide for Measuring and Reporting Daylight Illumination."
4. S. Q. and Q. Committee Report — "Avoidance of Discomfort Glare in the Design of Lighting Installations."

Coastal Empire Chapter Newest I.E.S. Group

The Society's 77th local group was established by action of Council June 12, in the approval of a Charter for the new Coastal Empire Chapter, with headquarters at Savannah, Georgia. The new Chapter, within the Southeastern Region, covers territory released by the Suwannee River Chapter, Georgia Section and Palmetto Section. Its active group of members have held a number of extremely successful meetings in Savannah during the past year.

SCHEDULED EVENTS

August 28-30, 1957 — American Institute of Electrical Engineers, Pacific General Meeting, Yakima, Wash.

September 9-13, 1957 — Illuminating Engineering Society, National Technical Conference, Biltmore Hotel, Atlanta, Ga.

September 13, 1957 — Council Meeting, I.E.S., Biltmore Hotel, Atlanta, Ga.

September 24-26, 1957 — Institute of Traffic Engineers, Statler Hotel, Detroit, Mich.

October 4-9, 1957 — Society of Motion Picture and Television Engineers, Hotel Sheraton, Philadelphia, Pa.

October 5-8, 1957 — International Association of Electrical Leagues, Sinton Hotel, Cincinnati, Ohio.

October 7-9, 1957 — National Electronics Conference, Inc., Hotel Sherman, Chicago, Ill.

October 10, 1957 — Annual Meeting, I.E.S., Society Headquarters, New York, N. Y.

October 7-11, 1957 — American Institute of Electrical Engineers, Fall General Meeting, Chicago, Ill.

October 8-10, 1957 — Electrical Progress Show, Convention Hall, Philadelphia, Pa.

October 9-11, 1957 — Canadian Electrical Manufacturers Associaiton, Sheraton-Brock Hotel, Niagara Falls, Ont.

October 17, 1957 — Society of Plastics Engineers, Regional Technical Conference on "Polyethylenes," Hotel Carter, Cleveland, Ohio.

October 18-19, 1957 — Professional Engineers of Oregon, Eugene Hotel, Eugene, Ore.

October 21-25, 1957 — National Safety Council, 45th National Safety Congress & Exposition, Chicago, Ill.

October 26-31, 1957 — National Association of Electrical Distributors, (Semiannual Meeting), Edgewater Beach Hotel, Chicago, Ill.

October 27-30, 1957 — National Association of Electrical Distributors (Board of Governors), Skytop Lodge, Skytop, Pa.

October 28-29, 1957 — Annual Meeting, United States National Committee, International Commission on Illumination, Nittany Lion Inn, University Park, Pa.

Week of November 10, 1957 — National Electrical Contractors Association, Cincinnati, Ohio.

November 11-15, 1957 — National Electrical Manufacturers Association, Traymore Hotel, Atlantic City, N. J.

November 18-21, 1957 — 10th Exposition of the Air-Conditioning and Refrigeration Industry, Navy Pier, Chicago, Ill.

December 1-6, 1957 — The American Society of Mechanical Engineers, Annual Meeting, Hotel New Yorker, New York, N. Y.

January 20-24, 1958 — American Institute of Electrical Engineers, Winter General Meeting, New York, N. Y.

January 27-29, 1958 — American Society of Heating and Air-Conditioning Engineers, Incorporated, Annual Meeting, Pittsburgh, Pa.

February 9-15, 1958 — National Electrical Week.

March 2-5, 1958 — National Electric Sign Association, National Convention, Shamrock Hilton Hotel, Houston, Texas.

June 9-13, 1958 — National Association of Electrical Distributors, 50th Annual Convention, San Francisco, Calif.

June 23-27, 1958 — American Institute of Electrical Engineers (Summer General Meeting), Buffalo, N. Y.

August 17-22, 1958 — Illuminating Engineering Society (National Technical Conference), Royal York Hotel, Toronto, Canada.

August 19-22, 1958 — American Institute of Electrical Engineers, Pacific General Meeting, Sacramento, Calif.

October 13-15, 1958 — National Electronics Conference, Inc., Hotel Sherman, Chicago, Ill.

October 20-24, 1958 — National Safety Council (46th National Safety Congress & Exposition), Chicago, Ill.

October 27-31, 1958 — American Institute of Electrical Engineers (Fall General Meeting), Pittsburgh, Pa.

November 10-14, 1958 — National Electrical Manufacturers Association (Annual Meeting), Traymore Hotel, Atlantic City, N. J.

Judges Named for International Lighting Competition

The Board of Judges has been selected for the various categories of the 1957 International Lighting Competition (see page 10A, May IE), being sponsored by the National Lighting Bureau and three McGraw-Hill trade magazines. These judges are:

Group A — Industrial store, office and institutional.

C. M. Cutler, General Electric Co., Cleveland, Ohio.
Professor Russell C. Putnam, Case Institute of Technology, Cleveland, Ohio.
Carl W. Zersen, Chicago Lighting Institute, Chicago, Ill.

Group B — Outdoor Lighting.

C. L. Crouch, Illuminating Engineering Society, New York, N. Y.
Charles W. Goddard, Edison Voicewriter Division, West Orange, N. J.
Professor Everett M. Strong, Cornell University, Ithaca, N. Y.

Group C — Residential Lighting.

Myrtle Fahsbender, Westinghouse Lamp Division, Bloomfield, N. J.
Edward A. Campbell, Better Light Better Sight Bureau, New York, N. Y.
William F. Little, recently retired president of Electrical Testing Laboratories, New York, N. Y.

Installations made between January 1, 1956 and October 25, 1957 are eligible. The 120 cash prizes offered total $5,400.

ATTENTIVE audience at technical session, Southwestern Regional.

Central Oklahoma — Host To Southwestern Regional Conference

Accommodations of the Holiday Inn, 15 miles from downtown Oklahoma City, were taken over when the 143 delegates and guests to the Southwestern Regional Conference moved in, the afternoon of April 28, for their two-and-a-half day meeting. This "get away from it all" conference site received general approval, and bus service to the nearby city enabled sight-seeing for those dedicated to this activity.

Following an afternoon of registration and a local activities meeting, a Sunday evening feature was the reception honoring President Marshall Waterman.

Getting down to serious business, Monday morning, the conference was opened by Regional Vice-President John G. Felton, Jr., and welcomed by a representative of Oklahoma City. Then on to the technical papers, which exhibited a noteworthy characteristic, which while not an innovation, strongly points a trend. This is that of the 19 speakers (including nine MMILJ contestants) all but four used visual aids — slides, including three-dimensional, and motion pictures. And, most visual of all, a bus tour to three Oklahoma City churches demonstrated lighting for traditional, contemporary and modern architecture in church buildings. Two bus loads and a number of car loads of delegates made the tour.

MMILJ Contest

Both categories — residential and commercial — of the contest for My Most Interesting Lighting Job drew competing entries, with Earl Dinsmore of Curtis Lighting winning in the commercial division, and Miss Ruth Patterson of Dallas Power and Light winning in the residential classification. Both are from the North Texas Section.

Other entrants in the two contests were:

Commercial — Dick Landry (San Jacinto Section), Elmer Prag (Central Okla-

(Continued on page 14A)

SOUTHWESTERN Regional Conference opened by John G. Felton, Jr., Regional Vice-President.

MMILJ Contest — Residential Division entrants: l. to r., Roger Gardner Jr., Jean Webster, Ruth Patterson and H. E. Laird. Miss Patterson was awarded first prize for her installation in her own home.

MMILJ Contest — Commercial Division entrants; l. to r., Dick Landry, Elmer Prag, Tom Lynn, R. K. Lothrop, who presented the entry of Q. W. Hargrove. First prize winner Earl Dinsmore was not present for photo.

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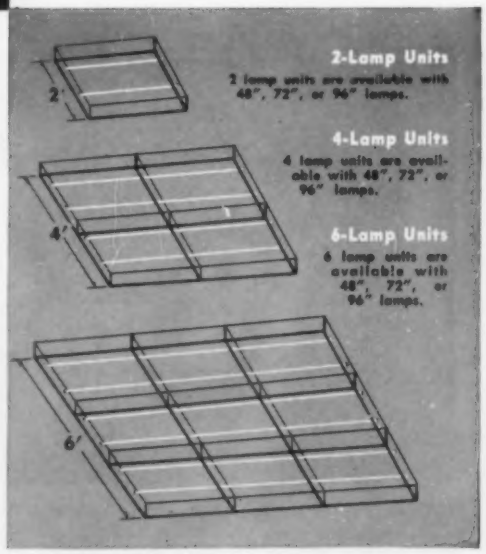
Panelaire

the newest *"pacesetter"* innovation in large area illumination

Provides an even distribution of high level light on the ceiling and "washes" the walls with glare-less illumination free of annoying contrasts.

Panelaire is ideal for offices, classrooms, drafting rooms, display and other areas where high levels of illumination are desirable. It is factory pre-assembled as a single unit, delivered complete in a single carton ready to install. Polystyrene louver diffusers with 45° shielding permit 200 foot-candles of comfortable illumination, easily interchangeable vinyl pan diffusers allow 100 foot-candle intensities. For complete Brochure send coupon below today.


2'
2-Lamp Units
2 lamp units are available with 48", 72", or 96" lamps.
4'
4-Lamp Units
4 lamp units are available with 48", 72", or 96" lamps.
6'
6-Lamp Units
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the "pacesetter" in the lighting industry

NAME..... ADDRESS..... CITY..... STATE.....

— FILL IN COUPON AND MAIL TODAY —

(*Continued from page* 12A)

homa Chapter), Tom Lynn (Panhandle Chapter), and Q. W. Hargrove (Ark-La-Tex).

Residential — Roger Gardner, Jr. and Jean Webster (Ark-La-Tex Chapter), H. E. Laird (Panhandle Chapter).

Fun and Gifts

As is usual at Regionals, the dinner-dance Monday evening was a social highlight of the conference, with the Holiday Room packed to capacity. It was then that the Sections, Chapters and Study Clubs of the Region presented to President and Mrs. Waterman their gift — an eight-place setting of Oklahoma Frankoma pottery dinnerware, each piece embossed "Oklahoma's Golden Jubilee, 1907-1957."

For the ladies the entertainment included the President's Reception, Monday luncheon and style show, a bus tour, luncheon Tuesday at the Twin Hills Golf and Country Club, and, of course, the dance.

CHARTERED buses were provided for the church lighting tour.

Program

Sunday, April 28

Registration
Local Activities Meeting
President's Reception

Monday, April 29

Morning — Clifford Ham, Chairman
Conference Opened — John G. Felton, Southwestern Regional Vice-President.
Welcome to Oklahoma City.
An Architect Looks at Lighting for the Future — Lee Sorey, Sorey, Hill & Sorey, Oklahoma City, Okla.
Lighting for Merchandising — Charles N. Clark, General Electric Co., Cleveland, Ohio.
Luncheon — F. Allen Whiteside, Chairman. Speaker — M. N. Waterman, I.E.S. President — Society Report.
Afternoon — R. G. Turpin, Chairman
Lighting Specifications — Limited? — Roy J. Thompson, Carnahan & Thompson Engineers, Oklahoma City, Okla.
I.E.S. Progress Report — James H. McCulloch, Independent Testing Laboratories, Boulder, Colo.
Church Lighting Tour by Bus.

Evening — Charles E. Davis, Chairman
Dinner and Dance.

Tuesday, April 30

Morning — T. J. Lynn, Chairman
High Output, 400-Cycle and Mercury Vapor Lamps — E. A. Linsday, General Electric Co., Cleveland, Ohio.
Air Traffic and Runway Lighting (EFAS) — S. C. Peek, Sylvania Electric Products Inc., Salem, Mass.
Building Engineers Look at Maintenance — Willard Malloy, Oklahoma City, Okla., and Charles Henderson, Tinker Air Force Base.
Luncheon — Curt W. Grevelius, Chairman. Speaker — Dr. James C. Harlow, Frontiers of Science Foundation of Oklahoma, Inc., Oklahoma City, Okla.
Afternoon — John B. Deck, Jr., Chairman
The Eye and Vision — Eric Church, Lighting Products, Inc., Highland Park, Ill.
My Most Interesting Lighting Job Contest.
Conference Adjourned — John G. Felton, Jr.

Credits

"Those who made it possible," in this case, include the following committee chairmen — and their committees — and officers in the Region:

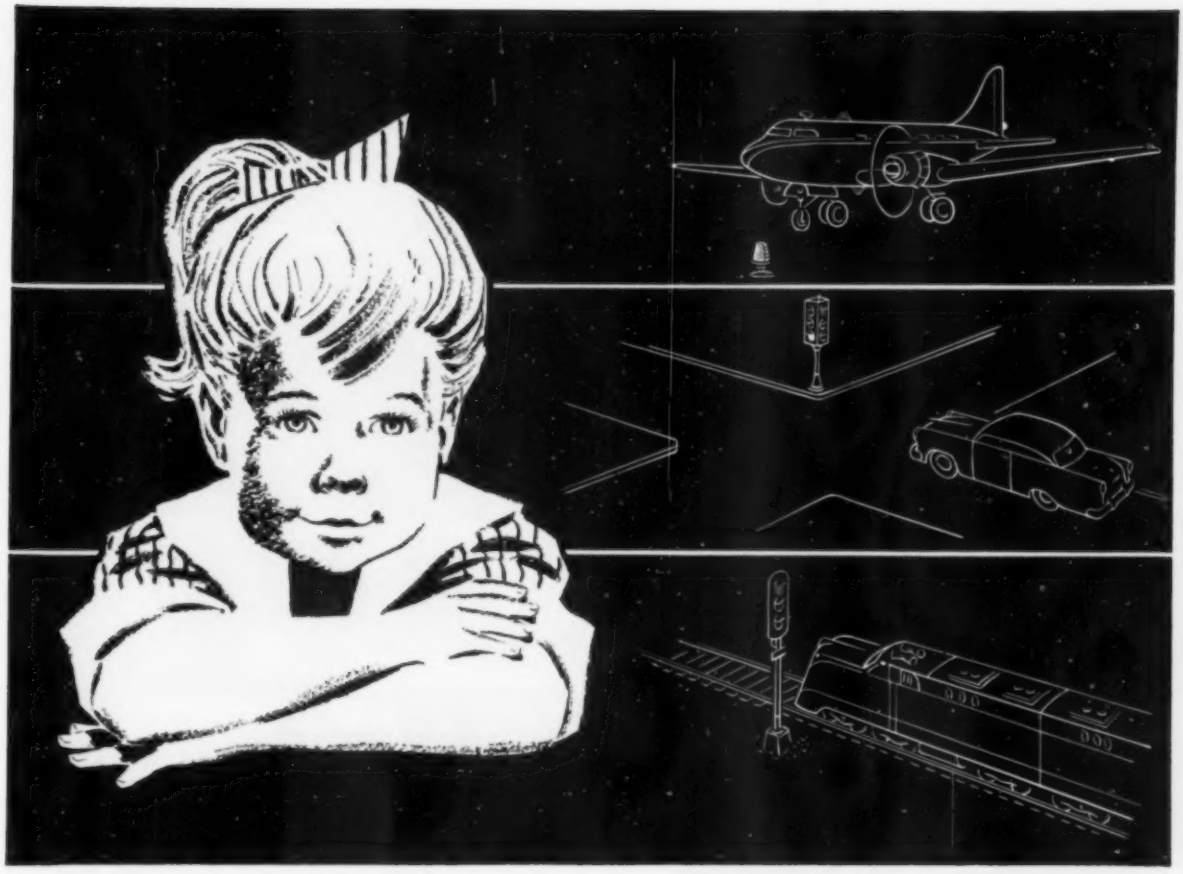
Committees

General Conference Co-Chairmen....W. S. Irving
J. D. Hampton
Papers and Program Co-Chairmen
Paul Sheline, Elmer Prag
R. L. Biesele
Finance.....Lloyd Boyles
T. M. Richardson

(*Continued on page* 17A)

GIFT from the Region to President and Mrs. Waterman was eight-place setting of Oklahoma pottery dinnerware. Presentation by Charles E. Davis, Chairman Central Oklahoma Chapter.

HOSTESSES for the ladies program: l. to r., Mrs. W. S. Irving, Mrs. Paul Sheline, Mrs. R. J. Thompson and Mrs. E. W. Gray.



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Furthermore, a Kopp-engineered product is manufactured of the finest, carefully-formulated ingredients. Every step in the production process is individually and rigidly controlled. Each product is thoroughly inspected and tested to assure highest quality and uniform dependability. That's why users of Kopp glass always receive top-quality performance—mighty important where human safety is involved.

Only a few of more than 1000 highly-specialized items made from over 100 varieties of glass by Kopp are shown below. Call us today for assistance in solving any industrial glass application problem which you may have.

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Litecontrol recessed curved-lens troffers were used throughout to do two jobs: (1) Staggered over the public area they provide moderate light intensity (2) Over the tellers' counters under the balcony, they step up the intensity to the precise high level that's needed. Even the mural on the wall is adequately lighted by the row of lens troffers — no supplementary lighting is used or required. The mural is clearly visible even from the street.

If *you* have photos to show of an installation like this, you know that you not only have a satisfied customer but you make a lot of new friends. Consider LITECONTROL on your next public lighting job.

INSTALLATION:
Watertown Federal Savings & Loan Association
Watertown, Massachusetts.

AREA:
Main banking area.

ARCHITECT:
Daniel C. C. Gilbert, New York City, New York.

ASSOCIATE ARCHITECT:
Davis Hamerstrom, New York City, New York.

DESIGNERS:
Benedict-Hamerstrom, New York City, New York.

CONSULTING ENGINEERS:
Albert Fentzloff, Inc., Gustave B. Weiser,
New York City, New York.

ELECTRICAL CONTRACTOR:
Hawes Electric Company, Watertown, Mass.

FIXTURES:
Litecontrol No. 4734RS in Public Area;
No. 4724RS in rows over Tellers' Counter.

INTENSITY:
Average in Public Area, 25 footcandles in service.
Average on Tellers' Counter, 85 footcandles in service.

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(*Continued from page* 14A)

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W. C. Wayland
Registration.....Bill Newman
C. E. Rice
Reception and Entertainment....Frank Rodesney
R. B. Gow
Transportation.....J. E. Comer
John Stevens
Property .....Erwin Leland
A. C. Hughes
Hotel.....W. S. Irving
Ladies Program .....Mrs. E. W. Gray
Mrs. W. S. Irving
Mrs. R. J. Thompson
Mrs. P. R. Sheline

OFFICERS

John G. Felton, Jr., Regional Vice-President
R. G. Turpin, Chairman, Alamo Chapter
Clifford Ham, Chairman, Ark-La-Tex Chapter
Charles E. Davis, Chairman, Central Oklahoma Chapter
F. Allen Whiteside, Chairman, Oil Capital Section
Thomas J. Lynn, Chairman, Panhandle Chapter
Curt W. Grevelius, Chairman, San Jacinto Section
John B. Deck, Jr., Chairman, North Texas Section.

For his President's Address at the Canadian Regional Conference, Marshall Waterman had in his audience almost all of the Region's Sustaining Members, invited specially for the occasion.

Fourteenth Canadian Regional Conference

Natural phenomena and I.E.S. activity teamed together for a successful conference in Canada May 16 and 17. Site was Sheraton-Brock Hotel, Niagara Falls, Ontario; Host Chapter, Hamilton. Actually, the scenery should be considered an extra bonus only; full credit goes to the Hamilton Chapter committee men. The "Convention-quality" atmosphere of most Canadian Regional Conferences, and certainly this one, has to be experienced to be appreciated. Typical Canadian touch: Regional V-P Joe Thomas met the President at the Buffalo Airport, escorting him personally to a press conference at the Sheraton-Brock.

Committee members commenced to arrive as early as the 14th to put in two full days of final preparation on decoration, lighting, and speakers' props. All Section and Chapter officers met on the evening of the 15th, prior to the conference, for a Local Activities session with national officers and headquarters staff.

The purpose behind the Conference, of giving the delegates information and stimulating their ideas, was evident from the keynote address onward. Keynoter was W. A. Dalrymple, of the Amalgamated Electric Company, whose address did indeed stimulate new thinking for lighting industry people. His premise: As an industry, we do not sufficiently get across to the public the truth that modern lighting is as important to the modern standard of living as are many of the now-widely-accepted living conveniences. His argument: In a new home these days, just as one example, even an electric refrigerator of say, circa 1950, would not be acceptable. It is taken for granted that it *must* have a frozen food compartment, automatic defrosting, and probably be in a color to match the kitchen. His point: first of all we must learn ourselves what we have to offer to people in terms of effects and values they understand. Wrenching ourselves from the technical aspects of lighting, teach *people* what they can do with light, and in what way good lighting can contribute to their modern standard of comfort, health and happiness. And in so doing create a real

(*Continued on page* 18A)

M. B. Hastings, right, a past Regional Vice-President, was presented with his certificate of Member Emeritus during ceremonies at the Banquet held during the Canadian Regional Conference. Applauding this honor are Mr. and Mrs. Joe Thomas (Regional V-P) and President and Mrs. M. N. Waterman.

One of the several distinguished speakers at the Canadian Regional Conference was Dr. A. P. Chan, center, Department of Agriculture, Ottawa. Left is Douglas MacMackin, chairman of the Maritime Chapter; at right, W. J. Montabone, past-chairman of the Ottawa Section.

A gift from the Region. President and Mrs. Waterman accept with delight, beautiful silver tray engraved as a lasting remembrance of the conference. Presentation was made by B. Field, center, Master of Ceremonies.

Canadian Regional Conference photos are courtesy of *Electrical News and Engineering.*

(*Continued from page* 17A)

desire in everyone to live better with better light.

President Marshall Waterman's address, also, emphasized this theme. He spoke before a packed luncheon session May 16. In his address, President Waterman noted that people are no longer interested in merely having enough light at low cost, but want versatility and refinements such as were never seen in general use before. He felt that the fact that four homes out of every five are poorly lighted is due, not to the fact that good lighting is not available, but that the general public is largely ignorant of basic principles in lighting. Mr. Waterman called for further exchange of ideas between lighting people and home decorators and designers.

Definitely one of the educational aspects of the conference was the Thursday afternoon (May 16) tour through the recently completed Sir Adam Beck generating station. This took the entire party, ladies included, first on a scenic trip down the Niagara River. Guides toured the station with the delegates, showing all particular points of interest. After touring the generating station, the group again boarded buses and traveled up the river toward the Falls, to a reception and dinner as guests of the Hydro Electric Power Commission. Dinner was served on the second floor of the Niagara Falls Refectory, in full view of the mighty spectacle which the Falls pre sent.

MMILJ

The morning session on Friday, May 17 had as opening feature the Region's contest for My Most Interesting Lighting Job. There were six contestants, from four Sections, with the following results:

First Prize, Class I: D. R. Webb, Maritime Chapter, "Freeform Luminous Ceiling for a Combined Living Room and Office."

First Prize, Class II: G. Denis, Montreal Section. "Three Store Lighting Applications."

Honorable Mention: Georges A. Watters, Quebec Chapter; J. H. Mills, Hamilton, Ontario Chapter; Ferris Abbass, Maritime Chapter; G. H. Perry, Montreal Section.

Friday also saw another luncheon meeting, with J. W. Kerr, Vice-President of Canadian Westinghouse Co. the guest speaker. Mr. Kerr's subject was "The Future of the Canadian Electrical Industry."

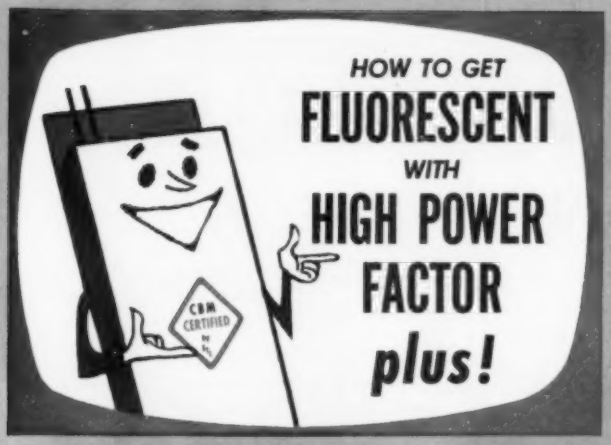
Social Program

Several items of the entertainment included the entire conference, gentlemen as well as ladies. Not the least of these was a daily tea hour, organized in the Hotel's dining room. The entire conference also participated in the tour of the generating station followed by dinner, and of course the President's Reception and Banquet.

The ladies did, however, have a pro-

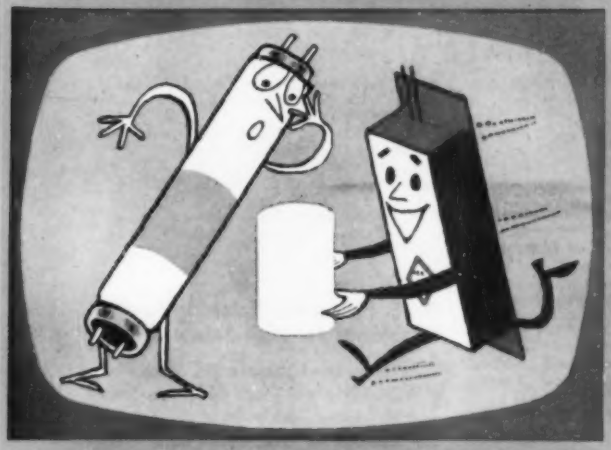
(*Continued on page* 20A)

My Most Interesting Lighting Job contest winners for the Canadian Region receive check and certificate. In picture at left Residential Class winner D. R. Webb, Maritime Chapter. In picture at right G. Denis, Montreal Section, received his prize from President Waterman. In background is Joe Thomas, Canadian Regional Vice-President.



HERE'S THE SECRET: Use fixtures with CERTIFIED CBM BALLASTS! Then you not only get High Power Factor, efficient use of current and lower installation costs, but you save on lighting costs, too.

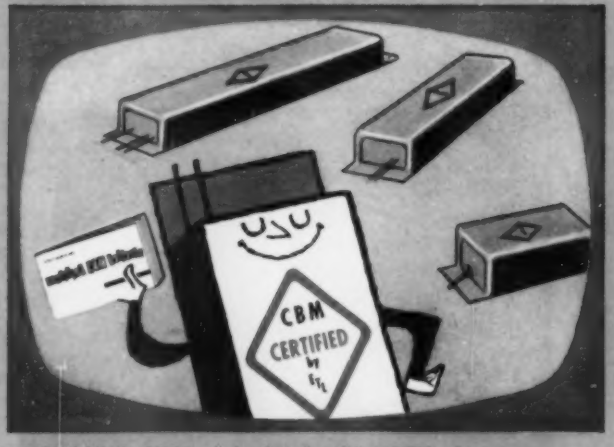
CBM GIVES JUST WHAT YOU NEED for proper fluorescent lamp operation. These ballasts are designed to give just the right amps and volts for peak lighting performance.



CBM BALLASTS GUARD YOU FROM LOSSES IN LIGHT OUTPUT... can save you up to 30%. For CBM means full, rated light output. And you get long ballast life, and up to 2500 hours more lamp life.

BUILT TO EXACTING SPECIFICATIONS for performance by 7 leading ballast manufacturers, CERTIFIED CBM BALLASTS are checked *and certified* by Electrical Testing Laboratories. They also carry the UL label.

MADE FOR EACH OTHER. Certified CBM standards are "tailored to the tube". So to get more for your money, be sure the fixtures you use are equipped with CERTIFIED CBM BALLASTS.



WRITE FOR A COPY of the free booklet, "Why it pays to use CERTIFIED CBM BALLASTS in fluorescent lighting fixtures". You'll find it helpful in knowing your best buy in fixtures.

Seven leading manufacturers now make up

CERTIFIED BALLAST MANUFACTURERS

CBM-5-B

2116 KEITH BUILDING • CLEVELAND 15, OHIO

Participation in CBM is open to any manufacturer who wishes to qualify

Annual Meeting

In accordance with Article VII Section 1 of the Constitution, the Annual Meeting of the Society is scheduled to be held at Society Headquarters 10 a.m., Thursday, October 10, 1957. The meeting will receive a report of the proceedings of the Society for the fiscal year 1956-1957.

R. G. SLAUER
General Secretary

(*Continued from page* 18A)

gram of their own. Under the leadership of Mrs. Rita Knapp, they started early the first day for coffee and acquaintanceship in the Rainbow Room atop the hotel. Besides new and renewed friendships, coffee and refreshments, they had Niagara's most spectacular view of the Falls. On Friday they met again for a tour which included all the highlights down the Niagara River toward Lake Ontario, including the beautiful Niagara Parkway Gardens. Luncheon was planned, at the Queenston Heights Restaurant, notable for its enormous open fireplace — a comfort in what was early Spring in Canada. This trip also took in a visit to the greenhouses above the Falls which specialize in an exotic array of rare plants.

The President's Reception and dance was, as always, a highlight. Receiving line included President and Mrs. Waterman, Mr. and Mrs. J. Thomas, Regional V-P; and Mr. and Mrs. John H. Mills, General Conference Chairman. During the Banquet, the Watermans were presented a gift from the Region, a beautiful Georgian design silver tray, engraved as a lasting remembrance of the Fourteenth Canadian Regional Conference. Master of Ceremonies for the affair was Billie Field, Hamilton Chapter.

TECHNICAL PROGRAM

For the record, the following lectures were presented during the Canadian Regional Conference:

Thursday, May 16

MORNING SESSION
Chairman, J. H. Rylance

Where Do We Go From Here?, by W. J. Dalrymple, Amalgamated Electric Co., Toronto, Ontario.
Don't Sell Incandescent Short, by Dick Smith, Sylvania Electric Products Inc.
Luncheon Session, Chairman, J. P. R. Cristal. Presidential Address by Marshall Waterman.

AFTERNOON SESSION
Chairman, G. Dubeau

Progress in Fluorescent Lamps and Lighting, by R. L. Zahour, Westinghouse Electric Corp., Bloomfield, N. J.
Tour and Reception, Hydro-Electric Power Commission.

Friday, May 17

MORNING SESSION
Chairman, Douglas MacMackin

My Most Interesting Lighting Job Contest.
Recent Techniques in the Control of Light, by G. G. Rae, Holophane Company, Inc., New York, N. Y.
Creativity in Canadian Lighting Design, by J. Carl Wilson, J. A. Wilson Lighting Display Co., Toronto, Ont.
Luncheon Session, Chairman, Grant E. Davidson. Speaker, J. W. Kerr, Vice-President, Canadian Westinghouse Co. Subject: The Future of the Canadian Electrical Industry.

AFTERNOON SESSION
Chairman, A. W. Evans

Progress in Mercury Sources, by Joseph W. Bateman, Canadian General Electric Co., Toronto, Ont.
Growing Plants with Artificial Lighting, by Dr. A. P. Chan, Department of Agriculture, Ottawa, Ont.

CREDITS

Following are the members to whom credit should go for the success of the conference:

J. Thomas, Canadian Regional Vice-President
John H. Mills, Conference General Chairman
C. Roy Hodge, Chairman, Papers & Programs
Edward I. Morwick and
N. E. Gerry, Secretaries
Chester Kuzniar, Treasurer
Edward Danes, Hotel Chairman
Billie Field, Entertainment Chairman
Cliff Knapp and Lloyd K. Hart,
Co-Chairmen of Publicity and Registration
Mrs. Rita Knapp, Ladies Program, with the Mrs. Mills, Hodge, Gerry, Kuzniar, Danes, Field and Hart.
James H. Rylance, Chairman Ottawa Chapter
G. Dubeau, Chairman, Quebec Chapter
J. P. R. Cristal, Chairman, Montreal Section
Douglas MacMackin, Chairman, Maritime Chapter
G. E. Davidson, Chairman, Toronto Section
A. W. Evans, Chairman, Bluenose Chapter

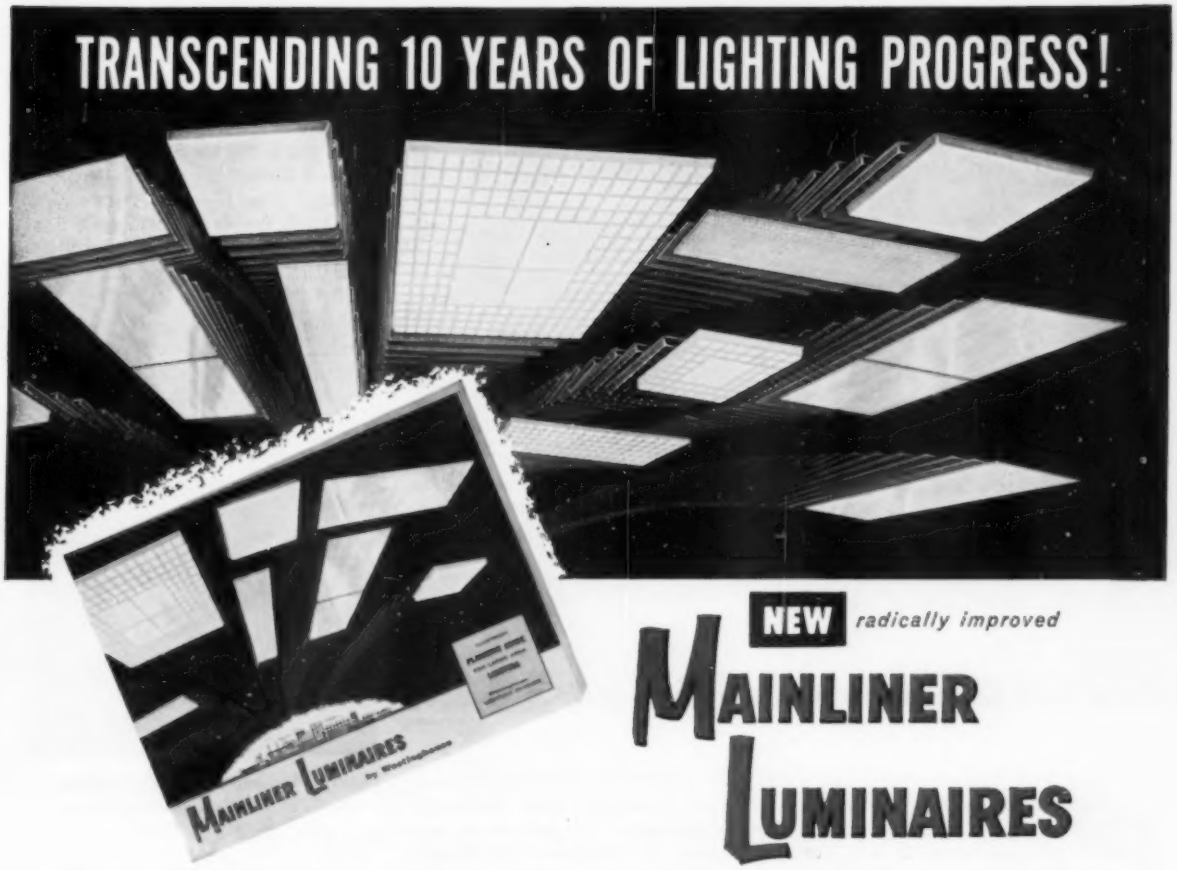
Dr. E. F. Lowry Scholarship Fund Established for High School Student

In memory of the late Dr. E. F. Lowry a scholarship fund has been established, to be awarded each year to the outstanding student of Danvers (Mass.) High School. Its prime purpose is to stimulate interest in physics and engineering as a profession and the award will continue until the fund is exhausted.

(*Continued on page* 22A)

SPEAKERS at the full-day conference on Outdoor Lighting, sponsored by the Rocky Mountain Section of I.E.S. and the Rocky Mountain Electrical League (see May IE, page 9A) were (right to left): Stan Starr, E. W. Beggs, A. J. Jaeger, R. E. Faucett, E. A. Linsday, H. A. Williams, James Howenstein, J. A. Setter. Another speaker on the technical program was W. A. Cyr, to whom applies also the credit line — Photos courtesy: *Electrical West*.

TRANSCENDING 10 YEARS OF LIGHTING PROGRESS!



NEW *radically improved*

MAINLINER LUMINAIRES

Exemplify every advancement made for ease and speed of application-installation and maintenance!

There is now a line of luminaires that incorporates *more improvements*—and permits *more optional variations* (in application sizes, shielding styles and mounting types) *than any other luminaires available before!* They are the *utterly* new, Mainliner Luminaires —created by Westinghouse!

These Mainliner Luminaires, for example, are designed precisely in 6 different multiples of exactly 12-inch modules. This is the modular planning declared *ideal*, by architects and designers, as *most* conducive to sound esthetic luminaire arrangement!—and *best* able to fulfill *virtually any interior lighting requirement.*

Mainliner shieldings include 13 different diffusers, lenses and louvers—each of *selected, most-appropriate* plastic, glass or steel!

Mainliner mountings are made by surface application, or in a *choice of 3 separate,* recessed-mounting types!

Mainliner housings have a *dimensional correctness,* exactly "mating" with any "squared" ceiling materials—are reinforced for much easier handling of so "shallow" a unit!—and are formed so that *no light escapes* around the door!

Doors open "either way". Flush, almost undiscernible latches have a positive, snap-action. All corners are mitered! And "Wrap-Around" wire-ways and "either-end" lead wires *simplify* installation!

Mainliner Luminaires *already* are creating *new concepts* of *modern, decorative* lighting!—*new, vigorous ideation* for capable, leading lighting designers!

J-04416

Get your copy of this newest, full-color PLANNING GUIDE FOR LARGE AREA LIGHTING from your nearest Westinghouse representative. You'll *want* to employ Mainliner Luminaires *now!*

YOU CAN BE SURE... IF IT'S Westinghouse

Certified Lighting for a Better America

Panel on Coordination of Lighting and Architecture at the Northeastern Regional Conference was an extremely valuable symposium. Experts participating were, l. to r., Rollo Gillespie Williams, Century Lighting; Maria Bergson, Interior Designer; and Harold Rambusch of Rambusch Decorating Co., New York. At right is A. A. Brodeur, Jr., Session Chairman.

New York City Has Northeastern Regional Conference

As everyone knows, New York City is loaded with talent. There are, to be sure, a number of disadvantages in New York as a site for a conference, but top-notch speakers for the program isn't one of them. Nor is extremely knowledgeable people for committee work. This combination paid off for the 165 delegates who attended the Northeastern Regional Conference at the Hotel Statler, New York, June 13 and 14. To wit: the completely unique panel symposium on Lighting, Color and Decoration; S. G. Hibben on "Futures Unlimited"; John Neidhart in person to explain the influence of new coefficients of utilization; R. D. Bradley to explain, himself, comfort ratings as influenced by new I.E.S. recommendations; plus other top speakers. (See complete program list.)

The Northeastern Region is not the strongest link in the MMILJ chain. The Big City Pace frequently takes its toll of this program. Four entries from three Sections, competed for the Regional prize, one in Class I (Residential), three in Class II (Commercial), all of them particularly interesting installations. Winners:

First Prize Class I — Sylvan Shemitz, New Haven Electric Supply Co., West Haven, Conn. for his "Lighting Excitement in a Home."

First Prize Class II — J. F. Barney, General Electric Supply Co. and Russell Benjamin, United Illuminating Co., both Bridgeport, Conn., joint entry, for their installation in the Stratford Public Library.

Futures Unlimited was the subject of S. G. Hibben's inspiring lecture.

Second — Walter J. Staples, Suburban Electric Co., Malden, Mass. (New England Section), "New Lighting for Used Cars."

Third — Julius Kaye, Holophane Co., Inc., New York, N. Y. "Gymnasium Lighting at Woodbridge High School."

Following the contest, and here's an

(Continued on page 25A)

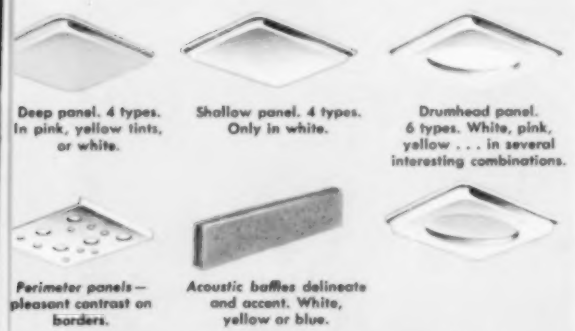
Registering three of the 178 delegates present are, seated, J. F. MacDougall and R. F. Wissoker of the New York Section (photo at left).

Information and hotel liaison (below) were in the hands of, l. to r., Duncan O'Brien and Page Woodbury.

This dynamic new area-illumination system brings your own individuality into interiors

Sylvania introduces Sylva-Lume

wall-to-wall lighting system



Deep panel. 4 types. In pink, yellow tints, or white.

Shallow panel. 4 types. Only in white.

Drumhead panel. 6 types. White, pink, yellow . . . in several interesting combinations.

Perimeter panels—pleasant contrast on borders.

Acoustic baffles delineate and accent. White, yellow or blue.

Now . . . with standard components like this ▲
You can custom-create lighting like this ▼

Complete Flexibility. Entire ceiling design can be changed easily, if desired, by re-arranging panels and baffles . . . to tie in with overall interior décor changes.

ANNOUNCING SYLVA-LUME, a dramatic new achievement in wall-to-wall lighting, by Sylvania!

Sylva-Lume; a new tool for design, giving unique individuality of expression to the architect and illuminating engineer.

Sylva-Lume; a new concept in the field of area illumination—quality lighting that is *"positively pleasant."*

With new Sylva-Lume, the ceiling area has been rediscovered as the logical medium for the contemporary imagination. Unlimited freedom of design now lies at your fingertips. You can custom-create *over 100,000 different lighting patterns* . . . using only a few standardized components . . . based on 36-inch modules.

Sylva-Lume brings more of *you*, your own individuality, into your interiors. Organize its elements of color, light, and form . . . get pattern, texture, mood and style, as you wish.

This dynamic new lighting system was developed by a creative group, for a creative profession. Sylvania engineers assisted by Peter Muller-Munk Associates, noted industrial designing firm, brought this artistically conceived creation into the realm of engineering practicality. *Write direct for folder of complete information.*

SYLVANIA ELECTRIC PRODUCTS INC.
Department G
Lighting Division—Fixtures
One 48th Street, Wheeling, W. Va.

SYLVANIA

. . . fastest growing name in sight

LIGHTING • RADIO • ELECTRONICS
TELEVISION • ATOMIC ENERGY

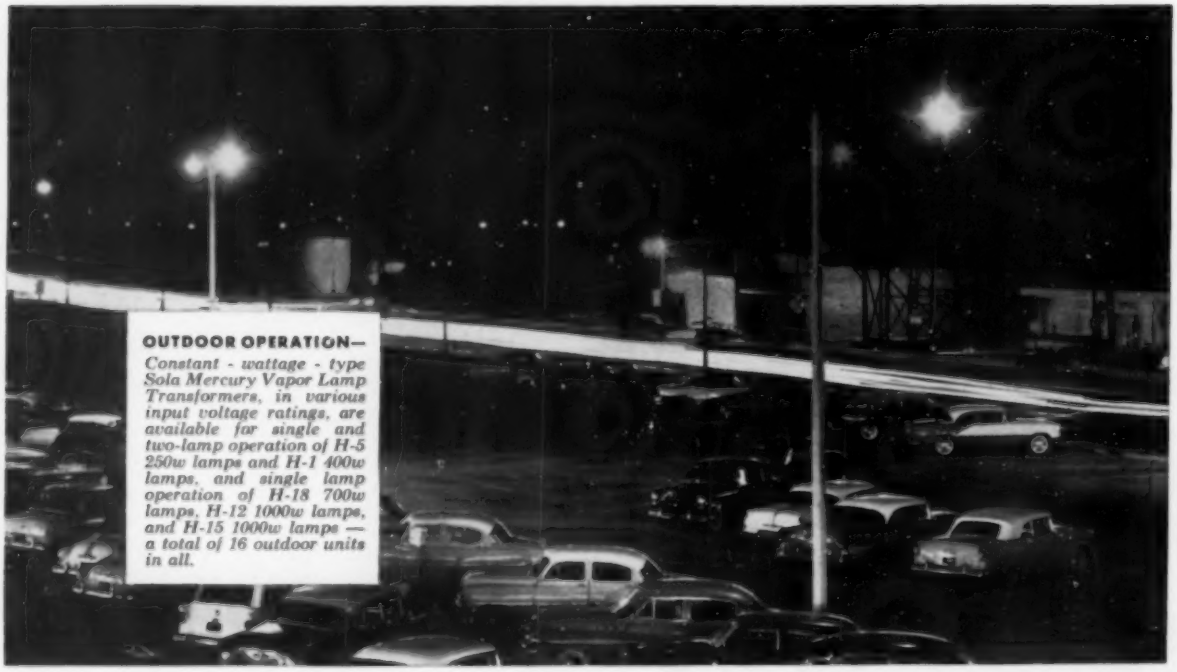
INDOOR OPERATION—
Constant - wattage - type Sola Mercury Vapor Lamp Transformers, in various input voltage ratings, are available for single and two - lamp operation of H-5 250w lamps and H-1 400w lamps, and single lamp operation of H-18 700w lamps, H-12 1000w lamps, and H-15 1000w lamps — a total of 20 indoor units in all.

Indoors or out--Sola offers the widest line of constant-wattage mercury lamp transformers

Constant-wattage transformers are fast becoming the generally-accepted standard for mercury vapor lighting. Indoors or outdoors, there's a Sola Constant Wattage Mercury Vapor Lamp Transformer available for every popular lamp size used in commercial and industrial applications . . . even two-lamp transformers for operation of H-5 250-watt lamps and H-1 400-watt lamps. Write for Bulletin MV-211 for Indoor Applications; Bulletins MV-219 and MV-244 for Outdoor Applications.

SOLA *Mercury Vapor Lamp* **TRANSFORMERS**

Sola Electric Co.
4633 W. 16th St.
Chicago 50, Ill.



OUTDOOR OPERATION—
Constant - wattage - type Sola Mercury Vapor Lamp Transformers, in various input voltage ratings, are available for single and two-lamp operation of H-5 250w lamps and H-1 400w lamps, and single lamp operation of H-18 700w lamps, H-12 1000w lamps, and H-15 1000w lamps — a total of 16 outdoor units in all.

Next Northeastern Regional Conference: April 10-11, 1958, Statler Hotel, Hartford, Connecticut.

(*Continued from page* 22A)

idea worth copying, the audience saw a slide presentation by Jerry Gillen of Consolidated Edison on "What's New in Lighting Around New York." Why some of these wonderful jobs weren't in the contest wasn't explained. Really new lighting techniques, many shown in color, were demonstrated in this interesting presentation. The judges of the MMILJ contest (Messrs. Bradley, Hartenstein and Waterman) retired during this feature to judge the entries, the winners being announced before the session adjourned.

MMILJ contestants: l. to r., W. J. Staples, New England Section; Sylvan Shemitz, first prize Class I, Connecticut: J. F. Barney, and R. W. Benjamin Jr., co-contestants for Connecticut Section first prize Class II; and Julius Kaye, New York Section.

Table for Banquet details, manned by G. Kolbe and J. Levinstein.

SOCIAL PROGRAM

While the high caliber of the technical program was definitely one of the advantages of a New York conference, it could be said that this goes double for the ladies' program. They had everything, and New York City too. Further, their program was under the direction of one of lighting's most talented women, Lillian Eddy of General Electric. There were some 30 ladies present at the conference, not counting local wives and committee members. Both mornings saw them all together for breakfast in a Statler suite reserved especially for them. Tours included the United Nations Building, the Circle Line three-hour boat trip around Manhattan Island; a guided tour through the model kitchens of *American Home* magazine, and tickets to every show but "My Fair Lady." Unscheduled trips were also made to the Cloisters; some went to the Museum of Modern Art, Radio City, and other places on a long list of things to be seen only in New York.

Highlight, of course, was the dinner-dance June 13 in the Statler Ballroom, preceded by the President's Reception. This event honored President and Mrs.

(*Continued on page* 26A)

At the Conference party, l. to r.: W. F. and Mrs. Little, retired President of ETL, with Walter Beagle, ETL's new president.

Kaffee Klatch was enjoyed each morning by the 28 ladies present at the Northeastern Regional Conference.

At the Northeastern Regional

L. to r.: Walter Beagle, Pres. ETL; Bob Hartenstein, Past IES Pres.; Ed Waldron, Regional V-P; Carl Holden, Chairman, New England Section.

George J. Taylor, Senior Vice-President; Mrs. Taylor and E. C. Huerkamp.

R. B. Burton Sr., left, with Berlon C. Cooper, McGraw Hill, and Clayt Ellis, Advertising and Promotion Manager of I.E.

R. L. Zahour, See New York Section; Sam Hazleton, Conference Chairman.

(*Continued from page* 25A)

Waterman, and in addition was a "fun-party" from start to finish. No speeches, superb food, floor-show entertainment, and dancing till one.

PROGRAM DETAILS

Thursday, June 13

MORNING SESSION

Chairman, C. D. Hollister

Keynote Addresses by: S. H. Hazleton, Conference Chairman, G. G. Rae, Chairman, Host Section, and C. E. Waldron, Regional Vice-President.

Futures Unlimited by Dr. S. G. Hibben, past-President, I.E.S.

Outdoor Lighting: Sign Techniques and Floodlighting by A. L. Hart, General Electric Co., Cleveland, Ohio.

AFTERNOON SESSION

Chairman, C. M. Holden

Influence of New Coefficients of Utilization by John Niedhart, Miller Co., Meriden, Conn.

Comfort Ratings as Influenced by New I.E.S. Codes by R. D. Bradley, Day-Brite Lighting Inc., St. Louis, Mo.

Servicing of Lighting Installations by Francis Clark, Lighting Services Inc., Waterbury, Conn.

Friday, June 14

MORNING SESSION

Chairman, A. C. Brodeur, Jr.

Lighting, Color and Decoration Symposium — Panel:

Harold Rambusch, Rambusch Decorating Co., New York, N. Y., "The Coordination of Lighting and Architecture."

Rollo Gillespie Williams, Century Lighting Inc., New York, N. Y., "Lighting and Color."

Maria Bergson, Maria Bergson Associates, Interior Design and Space Planning. "Color Application in Lighting."

AFTERNOON SESSION

Chairman, Merritt Horner

Dimmer Controls for Lighting by W. P. Carpenter, Superior Electric Co., Bristol, Conn.

My Most Interesting Lighting JJob Contest.

CREDIT DUE

The following talented people directed the various phases of the Northeastern Regional Conference:

Conference Personnel

C. E. Waldron, Vice-President, Northeastern Region

Merritt Horner, Chairman, Connecticut Section

C. D. Hollister, Chairman, Eastern New York Section

C. M. Holden, Chairman, New England Section

G. G. Rae, Chairman, New York Section

A. C. Brodeur, Jr., Chairman, Yankee Chapter

S. H. Hazleton, Conference Chairman

Sub-Committee Chairmen

E. H. Salter, Program and Papers

B. C. Cooper, Attendance and Publicity

W. H. Keen, Entertainment

B. J. Jensen, Finance

H. J. Peters, Hotel

Lillian Eddy, Ladies Program

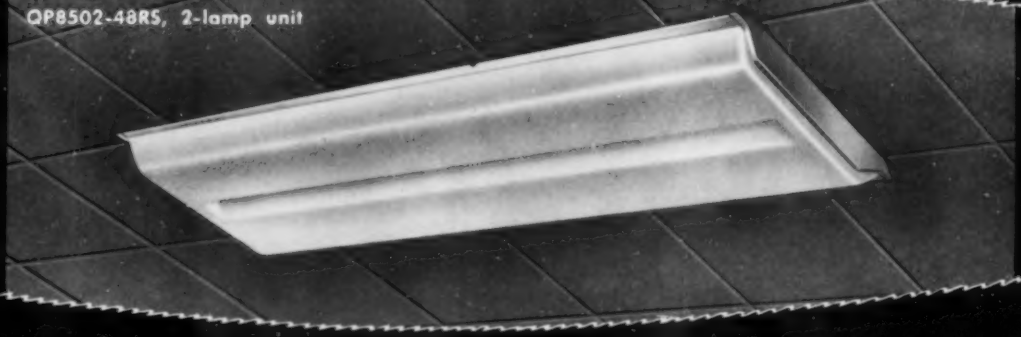
W. S. Till, Display and Decoration

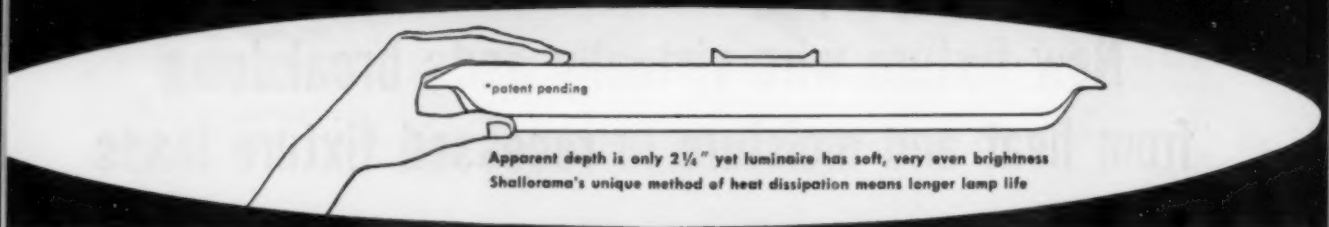
R. S. Wissoker, Registration and Reception

J. F. Dickerhoff, Transportation

(*Continued on page* 29A)

No latches, no hinges, no visible hardware mars the beauty of the SHALLORAMA®





Apparent depth is only 2¼" yet luminaire has soft, very even brightness
Shallorama's unique method of heat dissipation means longer lamp life

SHALLORAMA Lighting as modern as tomorrow

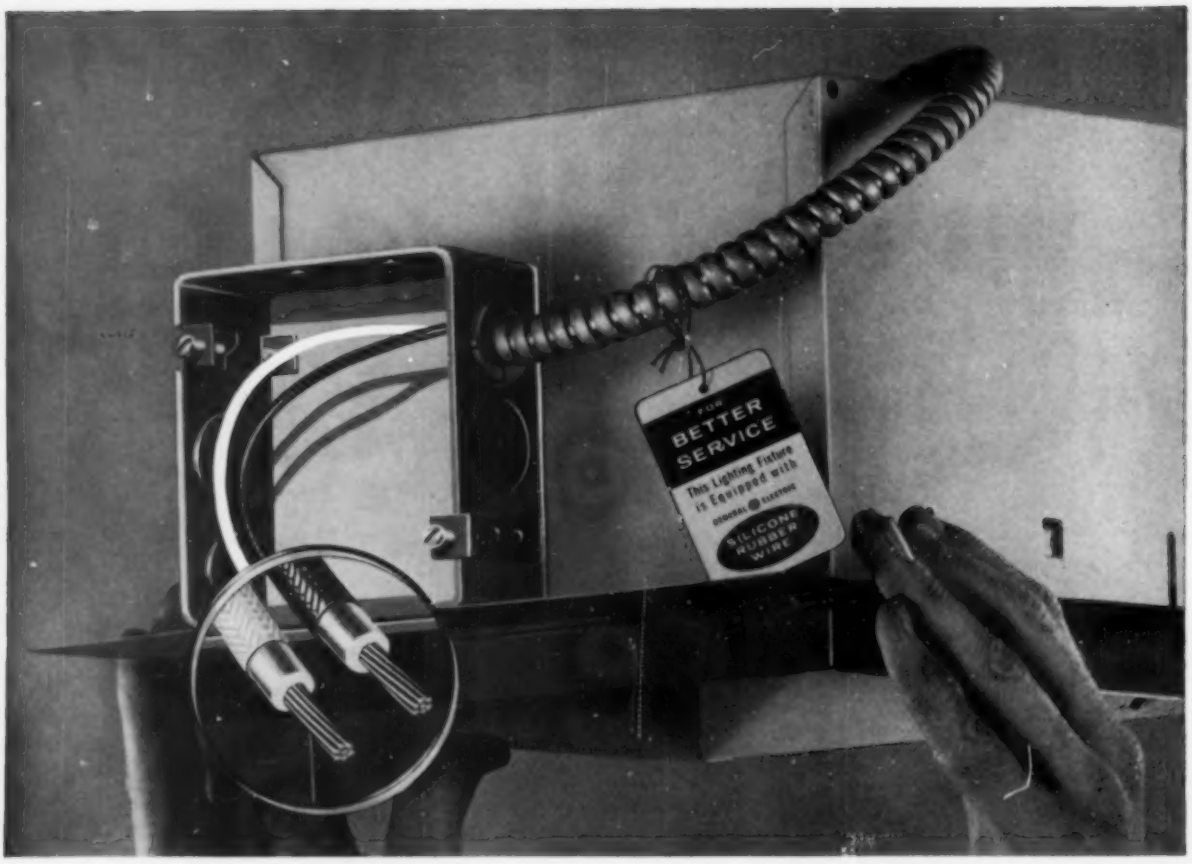
Long-life Plexiglas diffuser opens on continuous hook-on support from either side by one hand.

SUNBEAM visionaire

SUNBEAM LIGHTING COMPANY

777 East 14th Place, Los Angeles 21, California

See the SHALLORAMA at the Golden Anniversary Convention of the Nat. Assoc. of Building Owners & Managers, Booth #50.



New fixture wire virtually ends breakdown from heat and moisture in recessed fixture leads

Everyone agrees that a good recessed lighting fixture must be good *throughout*. It must operate faithfully so that callbacks and customer complaints are kept to a minimum. Until now, a major source of trouble has been failure caused by breakdown of the insulation of the lead wires.

These failures were usually caused by a combination of excessive heat and moisture trapped in and around the fixture. The problem is solved by General Electric's new silicone rubber wire. It operates safely at conductor temperatures as high as 200 C. And it has excellent resistance to moisture and heat-aging as well.

Listed by Underwriters' Laboratories, Inc., G-E silicone rubber wire meets the acute demand for fixture wire rated at least 150 C for use in wet locations. Because it is flexible, clean-stripping, and easy to handle, G-E silicone rubber wire requires no special installation techniques.

SHOW THEM YOU'VE GOT IT—Just display this tag. It proves your fixture is protected by G-E silicone rubber wire against insulation failures due to heat and condensation. And you can give your fixtures an extra boost by taking advantage of G. E.'s free promotion folders to include in your fixture packaging. When you use G-E silicone rubber wire, the tag and the packaging folders are yours, for the asking, from General Electric.

FOR COMPLETE SPECIFICATIONS and a sample, write Section W180-887, Wire and Cable Dept., General Electric Company, Bridgeport 2, Connecticut.

Progress Is Our Most Important Product

GENERAL ELECTRIC

(*Continued from page* 26A)

National Lighting Exposition Scheduled, New York, March 1958

The first national Lighting Exposition, aimed at being all-inclusive and bringing all segments of the industry under one roof, is scheduled to be held March 9 through 12, 1958 at the New York City Coliseum. The exposition is sponsored by Lighting Lamps & Electrical Manufacturers Salesmen's Associations, Inc.

Information on space and rates may be obtained from National Lighting Expositions, Room 618, 550 Fifth Ave., New York 36, N. Y.

Attendance Analyzed for Twin Cities Fair

Over 750 architects, engineers, electrical contractors and distributors representatives crowded the 1957 Twin Cities Lighting Fair, held earlier this year at the Calhoun Beach Hotel in Minneapolis. Some 363 architects and consulting engineers registered at the first session, and 411 electrical contractors and distributors attended the second.

Co-sponsored by the Twin Cities Section of I.E.S., the North Central Electrical League, and the Northern States Power Co., the Fair consisted of educational meetings coordinated with a lighting fixture exposition in which the latest developments of nationally known manufacturers of lighting equipment were displayed in 22 booths.

Speakers at the sessions were:

G. W. Frederick, General Electric Co., Minneapolis, Minn.
R. G. Slauer, Sylvania Electric Products, Inc., Wheeling, West Va.
W. H. Kahler, Westinghouse Electric Corp., Cleveland, Ohio.
C. N. Clark, General Electric Co., Cleveland, Ohio.
L. J. Riegert, B.M.D.&R., Inc., Minneapolis, Minn.
C. L. Crouch, Illuminating Engineering Society, New York, N. Y.
B. J. Martin, *Electrified Industry*, Chicago, Ill.
C. T. Bremicker, Northern States Power Co.

CHARTER of Section status is presented to F. W. Markland, incoming Chairman (in October) of the Southeast Florida Section by present Chairman J. V. Shellhorse. Over 80 members, their wives and guests attended the June 22 meeting.

Both days' sessions were summarized by L. E. Johnson, Northern States Power Co., who, as the originator of the Fair, spoke of its purpose and accomplishment. C. J. Aas was general chairman.

Cooperating with the Fair's sponsors were the Minnesota Society of Architects, the Minnesota Association of Consulting Engineers, and the Consulting Engineers Section of the Minnesota Society of Professional Engineers, and the St. Paul and Minneapolis Chapters of the National Electrical Contractors Association.

E.E. Teachers Meet

Electrical engineering teachers from colleges and universities throughout northeastern United States attended a "Conference on Electrical Engineering Education" at Raquette Lake, N. Y., May 31 to June 2. The conference, sponsored by the Electrical Engineering Department of Syracuse University was held for the express purpose of probing methods of teaching in the field of electrical engineering to augment the work on curriculum development being done in various committees of professional societies.

The program was designed to stimulate airing and development of ideas by having three speakers followed by small-group discussion sessions covering the three-day period. W. Scott Hill, manager of technical recruiting for General Electric Company and Sidney B. Ingram, director of Education and Training at Bell Telephone Laboratories, spoke on "Ideals in Engineering Education" at the first session on Friday evening. Saturday,

(*Continued on page* 31A)

AT THE Twin Cities Lighting Fair, photo at left shows Cecil H. Branham, program chairman; L. E. Johnson, whose idea the Fair basically was; and Brooks Cavin, president of the St. Paul chapter of A.I.A.; in photo at right are: Lou Riegert, speaker; C. J. Aas, general chairman of the Fair; G. W. Frederick, speaker; and William Kahler, speaker. Photos: *Northwest Architect*.

New! LOW COST LUXURY FOR MODERN LOW CEILINGS

metco Lighting

WRAP-AROUND

PlastoLier

SURFACE OR PENDANT MOUNTING

Shallower! *Only* **3½"** *deep*

smart modern one-piece

Wrap-Around Shielding

of extruded EVER-WHITE polystyrene

All-Welded 1-Piece Body

Light Weight

Complete 2-lamp unit weighs **17** *lbs. shielding alone* **2½** *lbs.*
Complete 4-lamp unit weighs **25** *lbs. shielding alone* **3½** *lbs.*

BUILT-IN UPLIGHTING

through plastic with no additional parts required, when mounted as suspended unit. Designed for individual installation or continuous runs. Available in 2 and 4-lamp sizes, each 4-ft. long. Write for prices and catalog sheet.

Certified Lighting for a Better America

Certified FLEUR-O-LIER CERTIFIED

Sold only through qualified electrical distributors

METALCRAFT PRODUCTS COMPANY, INC., Mascher and Lippincott Streets, Philadelphia 33, Pa.

(*Continued from page* 29A)

June 1, was devoted to a discussion of teaching, learning and communication, led by W. P. LePage, chairman, Electrical Engineering Department, Syracuse University, at a morning session. In the afternoon Gordon S. Brown, chairman, Department of Electrical Engineering at M.I.T., discussed "Curriculum Concepts" and at an evening session, W. L. Everett, dean of Engineering at the University of Illinois, was speaker. Sunday, June 2, featured a morning session on "Curriculum Structure," with John F. Ryder, dean of Engineering at Michigan State University as the speaker.

HALF-HOUR TV Show produced June 11 on Outdoor Lighting, by the Puget Sound Section, I.E.S. Ron Hartson conducts the program on KCTS-TV.

Changes Seen in Use of High Frequency Electric Power

A "quite different" future for the use of high frequency electric power was predicted at the Summer General Meeting of the American Institute of Electrical Engineers, held in Montreal, June 26.

"The outlook in the future for the generating, distribution and use of high frequency power will be quite different from that experienced in the last ten or fifteen years," Vernon C. Geckler, of General Motors Corp., Bristol, Conn., said in a paper "Industrial Application of High Frequency Power" in a session on industrial power systems.

"With the exception of special applications where there is a large fixed high frequency requirement, automation and integration lines will dictate the use of smaller size generating units located and sized specifically for a particular production line. Generating units used for these integrated lines will not be direct connected units but V-Belt driven units on which the belts may be changed to vary the generator speed to gain a different frequency or variable speed drives will be used to change frequency. This means a greater number of units to maintain but the end results of integration will warrant the application of these small units. In the not too distant future it is very possible that there will be developed an electronic unit which will be sufficiently small in size as to be installed on any one machine tool and will have the ability to vary its frequency within the range requirements of this machine."

(*Continued on page* 32A)

CONGRATULATIONS are extended (photo at left) to Jack M. Connauton, Chairman for 1957-1958 of the Edmonton Chapter, by Reg. Jarvis, right, currently serving as Chapter Chairman. In photo at right, the newly-elected executive committee of the Chapter: back row, Ron Vernon, Manager; Jack Connauton, Chairman; Herb Mather, Manager; Art Baragon, Manager; front row, Dennis Tucker, Manager; John Morgan, Recording Secretary; Fred Dorward, Secretary-Treasurer.

(*Continued from page* 31A)

High frequency, he said, has and will have application for internal grinding, portable tools for high production lines, wood-working machines and commercial and industrial lighting. The last two would include auditoriums, gymnasiums, large store areas and large manufacturing floors.

Installation Data Survey On Luminous Ceilings

Considerable installation data on luminous ceilings has been capsuled within one cover in the survey report compiled for 1955-1956 by the Commercial Committee, Business Development Section of the Pennsylvania Electric Association. A similar study is now under way for the association's 1956-1957 survey on "Extended Area Lighting Systems." The survey report compiles data on numerous types of interiors, covering watts per square foot, installed cost per square foot, maintained footcandles, and spacing for areas ranging in size from 120 square feet to 20,000 square feet, and for several types of luminous ceiling diffusers. Fifty-two installations were studied in the 1955-1956 survey, which includes very interesting analyses of the data obtained.

DINNER-DANCE, May 18, was attended by 140 members and guests of the St. Louis Section, I.E.S. Dance was held at the Tower Room of the Congress Hotel.

IT SEEMS TO ME

Great Britain and Continental Europe Research on Visual Comfort

We become so engrossed in the technical developments within the framework of our own national Society that we sometimes tend to forget the considerable contributions of others which are flowing in parallel channels so close at hand. It is presumed that the oversight is mutual, which makes it none-the-less regrettable.

Mr. Hopkinson's paper (May 1957 I.E.) has touched on one of our weak spots. A regular feature of the *Transactions of the Illuminating Engineering Society* during the 1930's was "Lighting and Architecture." This was the contribution of the Committee on Light in Architecture and Decoration which was so ably headed by Mr. Alvin L. Powell during those years. Possibly an effort should be made to fill the void created by the loss of Mr. Powell's contribution — but it is not a task to be undertaken lightly.

I do not think that anyone has to apologize even remotely for referring to the work of Lythgoe. From my slight knowledge of the literature, I have found nothing but support for his works. The Report No. 1 of the Committee on Standards of Quality and Quantity for Interior Illumination, "Brightness and Brightness Ratios,"[1] does this quite clearly. According to Lythgoe and the Report, a man in a black suit *is* a glare source, and in areas where visual comfort is a "must," I hope that we do not forget it, or move away from this position and work "towards the ideal solution"—whatever Mr. Hopkinson might have in mind as the 'ideal solution." We have seen the ill effects of and have worked too hard to banish black desk tops, black business machines and "rich mahogany finishes" from our interiors where prolonged critical seeing must be performed.

It is not intended to suggest that the man in the black suit should be barred from those areas where the demand for an effect takes precedence — such as in a church or a night club. Mr. Hopkinson does recognize that there are differences in requirements in his three stages, to wit: Lighting should (1) give good *visual efficiency*, (2) give *visual comfort*, and (3) have an *appropriate character*. When he issues a blanket indictment of the man in the black suit, he is being inconsistent.

There is a difference between Lythgoe's "pre-war" approach to the subject and the "modern" one. Lythgoe appeared to be concerned solely with an objective appraisal of the factors which he studied. The Report No. 1 of the S.Q.Q. Committee also presented relatively objective appraisals of the problems. The modern approach, however, does not have as its goal objective answers aimed at the elimination of glare but subjective answers to answer the question, "How much glare can be present before it is admitted that it is uncomfortable?" The goal is not to bring about unquestioned visual comfort for all observers in a given environment, but to provide tables and curves from which can be determined how many observers in a group will be "comfortable" even with a recognized source of glare in their visual field.

Such concentration on the undesirable is out of character for a Society which in the 50 years or so of its championship of quantity of light has never seen fit to prepare similar data for its Standards showing how little light should be provided on the basis of the number of observers in a group who would be "comfortable" with less than recommended levels of illumination. Since it appears that the Society intends to continue to advocate the approach that glare is acceptable which makes only one-half, say, of the observers admit discomfort, then the Society should be equally diligent in advocating the approach that substandard levels of illumination which make the same percentage admit discomfort is also acceptable. — WILLIAM G. DARLEY, *Consulting Engineer, San Antonio, Texas.*

1. ILLUMINATING ENGINEERING, Vol. XXXIX, p. 713 (December 1944).

(*Continued on page* 37A)

WHY THE ORIGINAL IS STILL THE BEST—

EXTRULITE® R1

**The first extruded and patterned plastic panel designed exclusively for the Lighting Industry.
Copied, after a fashion, but never equalled in either performance or appearance**

Here's Why:

TESTS PROVE, not only our own, but Tests of Five Independent Manufacturers show that Pattern R 1 offers

- Superior Light Control
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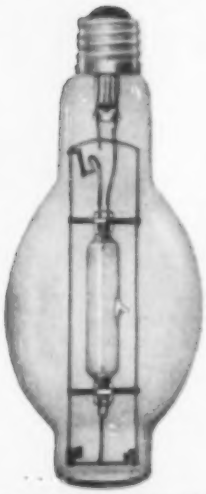
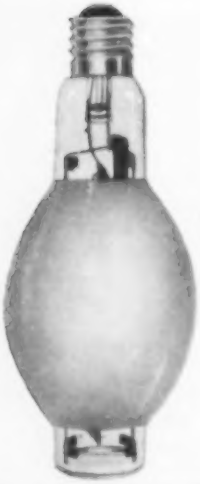


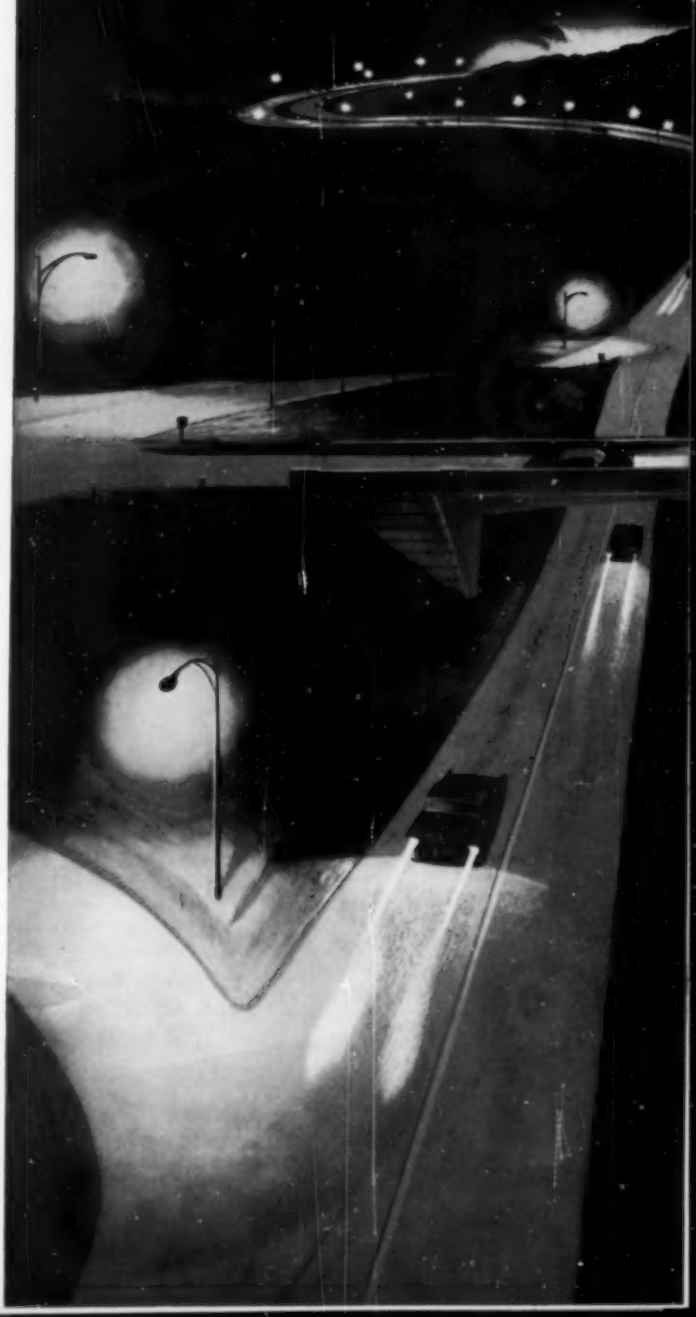
WESTINGHOUSE MERCURY LAMP E-H1—A 400 W. clear-glass quartz lamp designed for horizontal mounting; maximum illumination in a smaller lamp. 21,000 initial lumens make it ideal for city and highway lighting.

WESTINGHOUSE MERCURY LAMP E-H1-Y—Identical to the E-H1 except that a clear yellow filter of high transmission is permanently fused into the glass. For use in standard globe.



WESTINGHOUSE FLUORESCENT MERCURY LAMP J-H1—400 W. glass quartz lamp, color-corrected for golden-white light. Wide distribution of light from the luminaire due to large effective size of the light source.

WESTINGHOUSE FLUORESCENT MERCURY LAMP J-H1-Y—Identical to J-H1 except that it has a yellow filter in addition to its yellow phosphor coating. Approximates color of sodium closely enough for substitute installations.



HIGHWAYS SAFER...

Mercury Lamps

SPEED WITH SAFETY... that's the objective of today's highway engineers. Highway lighting must make super-highway speeds safe, warn of special conditions miles ahead.

That's why more and more planners and builders of roads are turning to Westinghouse to solve their lighting problems. And that's why more and more Westinghouse Mercury Lamps are going into service daily. Modern clear-glass Westinghouse Mercury Lamps give virtually shadow-free, high-level visibility . . . and with Westinghouse yellow Mercury Lamps, turn-offs and danger areas can't be missed.

Two new Westinghouse yellow Mercury Lamps, E-H1-Y and J-H1-Y, may be simply substituted for uncolored lamps in standard fixtures where a yellow light is wanted, eliminating external filters or colored globes.

MORE WESTINGHOUSE MERCURY LAMPS ARE IN USE TODAY THAN ALL OTHER MAKES COMBINED

Not only does Westinghouse make more kinds and types of Mercury Lamps than anyone else, their pioneering leadership pays off in *substantial installation and operating economies.*

Westinghouse Mercury Lamps give more light when new . . . more light for a longer life. This means maintenance and replacement costs are cut . . . without sacrificing vitally needed light levels and safety standards.

BASIC CONSTRUCTION ADVANCES are another reason why you should specify Westinghouse for street, road and highway. For instance:

- **Thorium-Coated electrodes provide** HIGHER LIGHT OUTPUT
- **Molybdenum Ribbon Seal assures** GREATER DEPENDABILITY, LONGER LIFE
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YOU CAN BE SURE...IF IT'S

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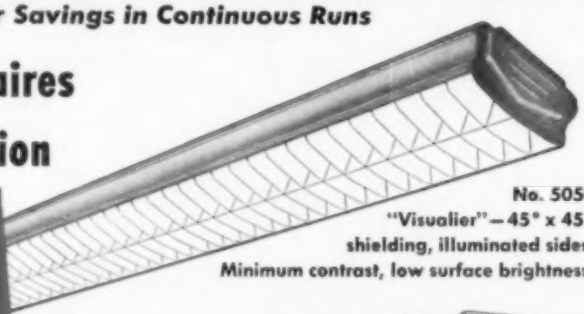
Over 50% Labor Savings in Continuous Runs

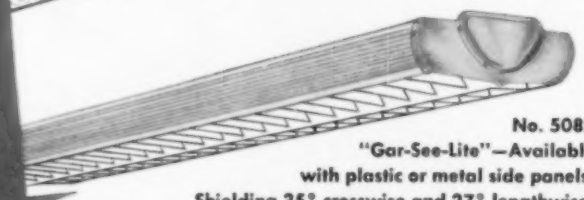
Premium Quality Luminaires for Speed-Line Installation

THIS IS THE GARCY *Speed-Line*® SYSTEM

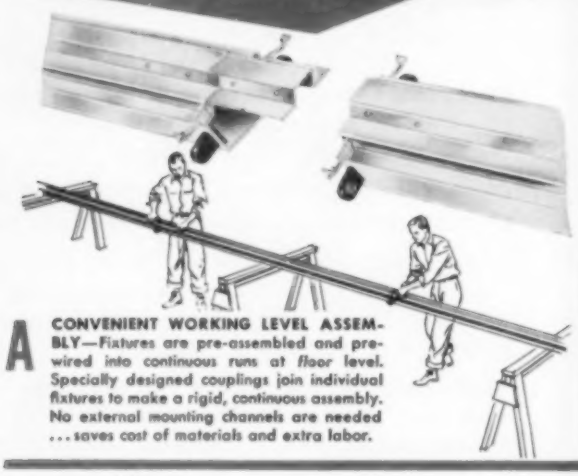
optional at no extra cost with Garcy Visualier and Gar-See-Lite Fixtures



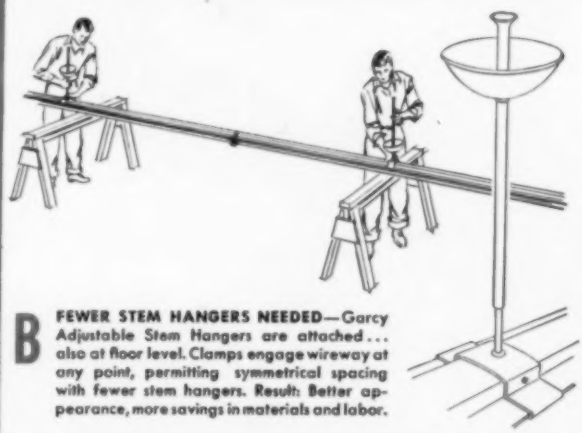
No. 5050
"Visualier"—45° x 45° shielding, illuminated sides. Minimum contrast, low surface brightness.



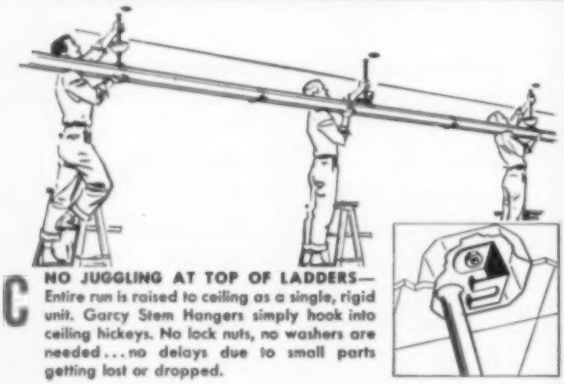
No. 5082
"Gar-See-Lite"—Available with plastic or metal side panels. Shielding 35° crosswise and 27° lengthwise.



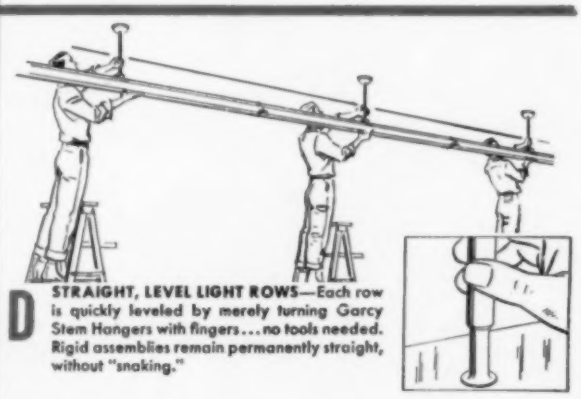
A **CONVENIENT WORKING LEVEL ASSEMBLY**—Fixtures are pre-assembled and pre-wired into continuous runs at floor level. Specially designed couplings join individual fixtures to make a rigid, continuous assembly. No external mounting channels are needed ... saves cost of materials and extra labor.



B **FEWER STEM HANGERS NEEDED**—Garcy Adjustable Stem Hangers are attached ... also at floor level. Clamps engage wireway at any point, permitting symmetrical spacing with fewer stem hangers. Result: Better appearance, more savings in materials and labor.



C **NO JUGGLING AT TOP OF LADDERS**—Entire run is raised to ceiling as a single, rigid unit. Garcy Stem Hangers simply hook into ceiling hickeys. No lock nuts, no washers are needed ... no delays due to small parts getting lost or dropped.



D **STRAIGHT, LEVEL LIGHT ROWS**—Each row is quickly leveled by merely turning Garcy Stem Hangers with fingers ... no tools needed. Rigid assemblies remain permanently straight, without "snaking."

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COMPLETE COMMERCIAL LIGHTING

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1730 North Ashland Avenue • Chicago 22, Illinois
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(*Continued from page 32A*)

Reply

I have been given the opportunity to reply to Mr. Darley's comment on my paper, which was published in the May issue of I.E. The paper is a transcript of a lecture which I gave to the symposium on Visual Research held at Cornell University in September last year. After the paper we had a long and lively discussion which I think was far more important than the paper itself. In this discussion the points raised by Mr. Darley came up in one way or another although I do not think we produced any definitive answer to them.

It is necessary to explain that in the lecture I delivered there was no hint of apology for referring to the work of Lythgoe, but I agree that the published paper can read that way. The point I made was that whereas in America you were able to keep the threads of your lighting research unbroken throughout the war years, we dropped almost completely our research work on the lighting of buildings except as it influenced wartime conditions and wartime production. For that reason in picking up the threads after the war, we found it continuously necessary to refer back to the best work of the 1930 period — my purpose was a statement of fact and explanation, not to convey an apology. I agree completely with Mr. Darley that nobody needs to apologize for referring to the work of this period.

Again, I did not intend to issue a "blanket indictment" of the man in the black suit. Where he is appropriate to the environment, let us have him. In fact, I was criticizing the "three-to-one brightness engineers" who would exclude him from everywhere.

Mr. Darley's last paragraph touches the crux of the problem of specification and codes of practice. I think it is quite logical that, if standards for visual comfort are to be laid down in terms of the proportion of the general population who will experience a given degree of discomfort, so should codes of practice on lighting levels. That is in fact what I have been advocating in Great Britain for some years, and have succeeded in getting adopted where I have the necessary influence. Regulations on School Buildings of the Ministry of Education of Great Britain, for example, are based, in their lighting paragraphs, on just this concept. The statutory levels of minimum illumination are not based on average visual performance, but are such as will enable 85 per cent of normal sighted children to achieve an agreed standard of visual acuity and "ease of seeing" under typical British classroom conditions. Similarly the levels of permissible brightness of lighting units are based on the values nec :sary for 85 per cent of normally sighted children to experience a degree of visual discomfort no worse than that described by the third criterion of the multiple criterion scale (Criterion C, "just acceptable"). The figure of 85 per cent was chosen for reasons which are explained elsewhere — the distribution of visual faculties among a normal group of school children is such that to get a substantially greater proportion than 85 per cent into the bracket, difficult or economically impossible changes in the lighting would be demanded. One must compromise between expediency and perfection. I think that this is also what Mr. Darley wants to do. — R. G. HOPKINSON, *Department of Scientific and Industrial Research, Building Research Station, Garston, Watford, Herts, England.*

Obituary

Duncan F. Preston

Duncan F. Preston, engineer with Detroit Edison Co. for 30 years and active member of the Michigan Section of I.E.S., died July 7 at his home after a short illness.

Mr. Preston served the Michigan Section on several of its committees, and was a first place winner in the national contest for My Most Interesting Lighting Job in 1955.

1958 Regional Conferences, I.E.S.

Region	Place	Date
Northeastern	Statler Hotel Hartford, Conn.	April 10-11
East Central	John Marshall Hotel Richmond, Va.	April 14-15
South Central and Southeastern	Lafayette Hotel Little Rock, Arkansas	April 24-25
Southwestern	Washington Youree Shreveport, La.	April 28-29
Midwestern	Hotel President Kansas City, Mo.	May 1-2
Inter-Mountain	Whitman Hotel Pueblo, Colo.	May 8-9
South Pacific	El Cortez Hotel San Diego, Calif.	May 14-15
Pacific Northwest	Multnomah Hotel Portland, Oregon	May 22-24
Great Lakes	Sheraton Hotel Rochester, N. Y.	June 23-24

ABOUT PEOPLE

By unanimous action of the I.E.S. Council, at its June 12 meeting, **Leo Dolkart** was elected Member Emeritus of the Society. Mr. Dolkart is a Charter Member of I.E.S. and remains active in the Chicago Section.

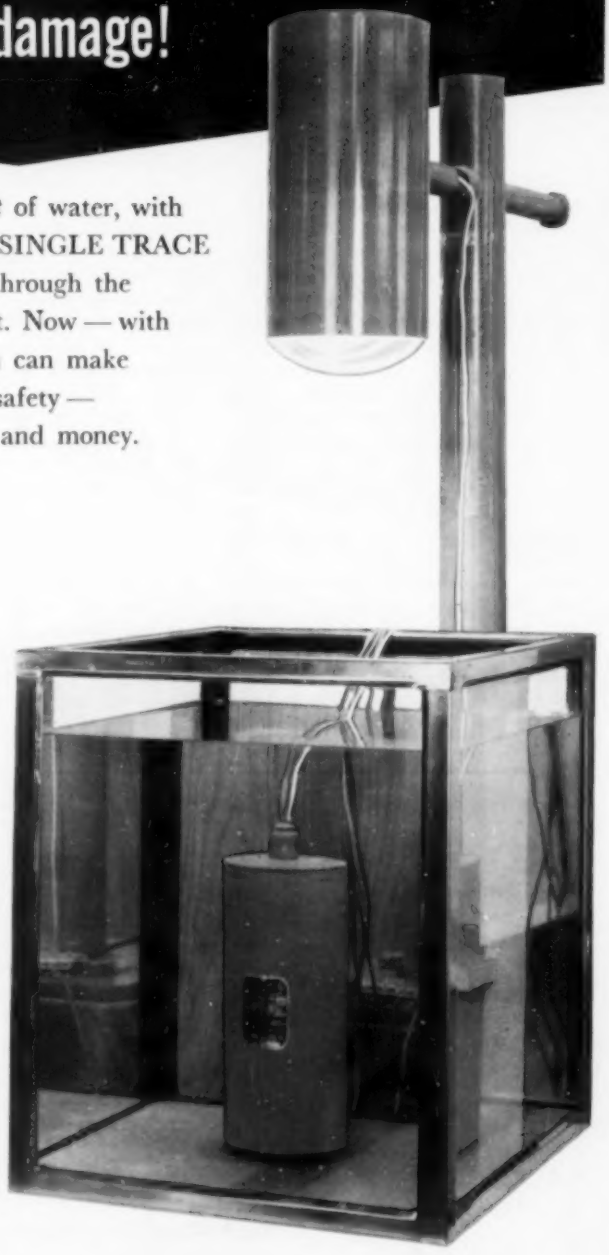
Grant Curry, one of the founders of Kopp Glass, Inc., has retired as treasurer of the company, continuing as a director. Mr. Curry has been with the company since he helped to establish it in 1926. **G. D. Hammond** has been elected treasurer and secretary of the Swissvale, Pa., firm.

William P. Lowell, Jr., Manager of Commercial Engineering for the Lighting Division, Sylvania Electric Products Inc.,

(*Continued on page 46A*)

At Last!

Pole base MERCURY LAMP BALLASTS that moisture cannot damage!



Through on/off operations, *in* and *out* of water, with *high heats* and *quick cool-offs,* NOT A SINGLE TRACE OF MOISTURE was able to break through the waterproof barriers of this new ballast. Now — with this new Jefferson development — you can make pole base installations with complete safety — at an important saving of your time and money.

30 DAY UNDERWATER TEST GIVES POSITIVE PROOF THAT NO MOISTURE CAN ENTER THIS JEFFERSON BALLAST

(a) Continuously submerged for 15 days — tested on lamp with alternate cycles of 8 hour operations followed by 16 hour shut-offs. No change in insulation resistance gave *positive evidence of no moisture in ballast.*

(b) Intermittent submersion for 15 days — with alternate cycles of on-operation for 8 hours *out* of water . . . followed by 16 hours of shut-off underwater. *Again* — no change in insulation resistance gave proof of *no moisture inside ballasts.*

NO TAPING REQUIRED . . . Now you can completely eliminate the time-consuming costly weatherproof taping of pipe nipples or wiping sleeves. You just splice and tape line and lamp leads and the job is done!

NO HANDLING DAMAGE . . . The new Jefferson AQUALIFT sealant withstands up to 500 lbs. pull when it is lifted by all the leads at once — a multiple safety margin for the roughest handling.

PRODUCTS WORTHY OF THE NAME

Jefferson ELECTRIC COMPANY
BELLWOOD, ILLINOIS

Engineers: Holmes & Narver, Inc.
Los Angeles, Cal.

Contractor: Newbery Electric Corp
Los Angeles, Cal.

22 Acres of Custom-Engineered Lighting by HOLOPHANE

In the great new Douglas Aircraft Plant at Long Beach, California, you can see clearly for more than 1000 feet—with a high degree of visual comfort....Reason: the lighting is produced by 5767 Holophane Prismatic HIBAY* reflectors...to our knowledge, the greatest accumulation of controlled illumination under one roof!

Holophane luminaires had been used by Douglas for many years ...The decision to install them in this new plant was another endorsement of Holophane lighting superiority.

Through research and development Holophane engineers are discovering new and better methods to meet the lighting problems of the nation's expanding industries. Chances are, they can help solve your problems, too. You may consult Holophane, through architects and engineers, without obligation.

*®

Typical Holophane HIBAY Reflector

To be sure of quality in Reflectors look for the name HOLOPHANE impressed on each piece.

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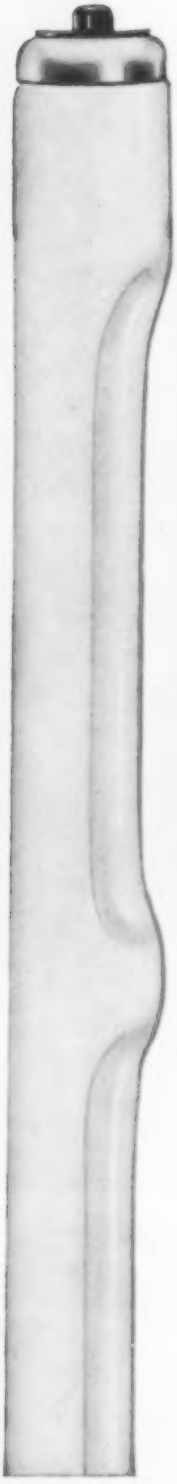
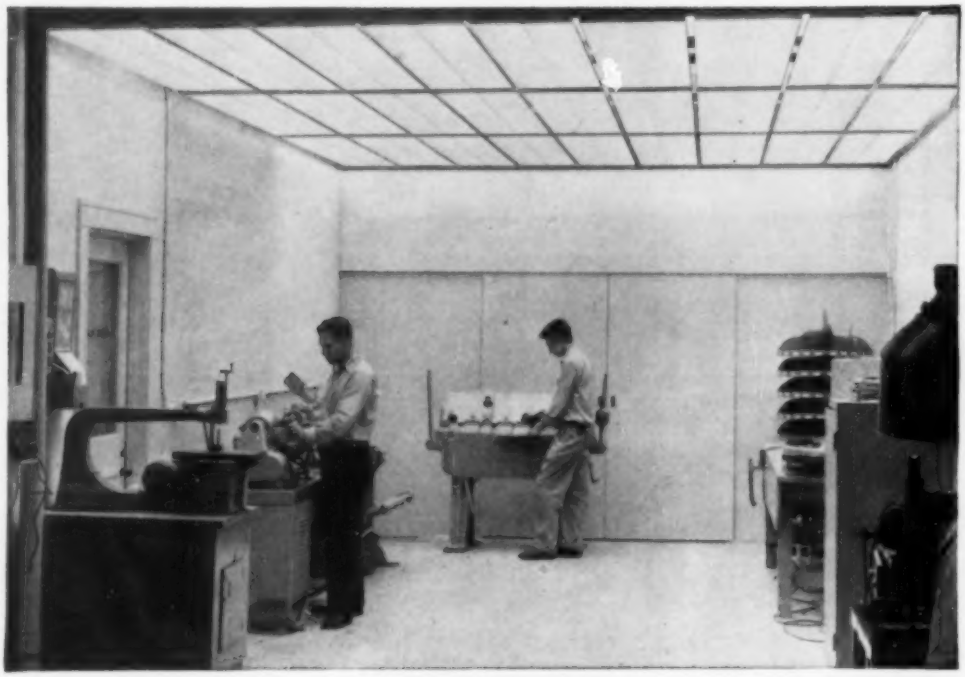
Specify G-E "Power-Groove" Lamps to give your customers a higher, more economical lighting level



Actual installations of General Electric's new "Power-Groove" Lamps are proving the advantages demonstrated in "World's Brightest Workshop"



TODAY, at General Electric's Lighting Institute in Nela Park, the workshop shown above uses new G-E "Power-Groove" Lamps to produce a lighting level *more than double that of any other known industrial installation!* It's an actual work area, demonstrating that "Power-Grooves" are ideal for use in most industrial areas, behind louvered ceilings in stores and offices, and for street lighting, signs and other outdoor applications.

G-E "POWER-GROOVE" LAMPS SAVE INVESTMENT DOLLARS. Because your customers get almost twice as much light per tube as High-Output fluorescents . . . 2½ times as much as 8-foot slimlines . . . you can now give them more light per fixture. Besides having fewer parts to maintain, there is a 5-20% savings on initial investment compared to other fluorescent lighting systems.

GET THE WHOLE EXCITING "POWER-GROOVE" STORY! Write to General Electric Co., Large Lamp Dept. IE-87, Nela Park, Cleveland 12, Ohio. Or visit this workshop yourself for an on-the-spot demonstration of how G-E "Power-Grooves" can work for *your* customers.

Progress Is Our Most Important Product

GENERAL ELECTRIC

TWA TICKET OFFICE, ROCKEFELLER CENTER

Interiors with sales appeal have wall-to-wall Honeylite.

There's a big reason why two major transportation companies in one month have chosen Honeylite for their important Manhattan ticket sales offices. The reason is customers like a Honeylite atmosphere and buy! (Employees like Honeylite, too, and make fewer errors because their eyes are fresh and rested all day long.)

Why does the public like a Honeylite ceiling so much? Well, first of all, Honeylite is always spotlessly clean. Dust and dirt just fall through—can't stick to Honeylite because it's non-static. Honeylite rooms have a cool and airy feeling. Overhead air-conditioning systems are actually made more efficient by the thousands of little hexagonal "wind tunnels" in each square foot of Honeylite...(yet these unsightly utility systems are obscured). And, of course, Honeylite casts a completely glare-free flattering light—with nearly perfect efficiency.

See our Catalog in Sweet's file 21a/He

HONEYLITE®

LIGHT-DIFFUSING ALUMINUM HONEYCOMB
A DEVELOPMENT OF **HEXCEL PRODUCTS INC.**
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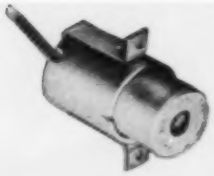
Channel Screw Terminal Type
for T-8 Lamps

Channel "Quick Connect" Type
Rear Terminal Tabs for T-8 Lamps

Channel "Quick Connect" Type
Front Terminal Tabs for T-8 Lamps



Slimline Plunger—Butt-on
High Voltage End Lead Terminal Type
—with or without mounting bracket
for Slimline Lamps

Medium—Single Screw Terminal
Type for T-8 and T-12 Lamps

Medium—Combination Screw Terminal
Type for T-8 and T-12 Lamps

Medium—Butt-on
Lead Terminal Type
for T-8 and T-12 Lamps

Slimline Plunger—Butt-on
Low Voltage End Lead Terminal Type
—with or without mounting bracket
for Slimline Lamps

Slimline—Butt-on High Voltage End
Screw Terminal Type
for Slimline Lamps

Slimline—Butt-on Low Voltage
End Screw Terminal Type
for Slimline Lamps

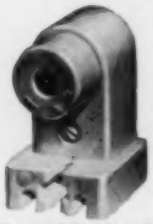
Sylvania fills every basic need for

Fluorescent Wiring Devices

- Sylvania's complete line can provide the exact lamp holder or starter socket to meet your requirements.

These wiring devices are carefully manufactured to Sylvania's exacting standards, and are approved by Underwriters' Laboratories and Canadian Standards Association Approvals Laboratories.

When you need the best in fluorescent wiring devices, see Sylvania. For complete details and specifications, write for catalog.



Slimline Fixtures High Voltage End
Screw Terminal Type
for Slimline Lamps

Slimline Fixtures Low Voltage End
Screw Terminal Type
for Slimline Lamps

Medium—Separate
Lead Terminal Type

Medium—Butt-on
Lead Terminal Type
—with or without mounting bracket

SYLVANIA PARTS DIVISION

Sylvania Electric Products Inc., Parts Division, Warren, Pennsylvania

SPECIAL WIRE · METAL STAMPINGS · MOLDED PLASTIC · ELECTRONIC COMPONENTS

4-way service from one source

. . . the man from Smithcraft

*George Kolbe, manager of Smithcraft's New York City team of Kolbe, Goren and Smith . . . part of the nationwide Smithcraft sales organization.

. . . 4 good NEW ideas in lighting

CIVIC—an architectural form . . . shallow, good-looking and in excellent taste. An extruded aluminum-framed unit.

TWOSOME — Top value, low cost, shallow and attractive. With new 45° x 45° compound shielding, or with plastic louvers, flanged polystyrene or various types of glass.

EXECUTIVE — an all-steel louvered unit; shallow with illuminated, tapered sides. Provides 30° x 45° shielding.

FREEWAY—Modern, architectural corridor-lighting . . . Totally enclosed. Clean, simple plastic shielding.

In addition to the CIVIC and the TWOSOME, Smithcraft's new developments include the EXECUTIVE and the FREEWAY. You'll find all four units useful to you in the planning of lighting for today's interiors.

He's the man whose experience and knowledge of lighting is backed by Smithcraft's highly diversified line of fluorescent lighting units. The "Man from Smithcraft" can suggest the new CIVIC, for example, for interiors requiring the very finest in "prestige lighting". Or he can turn to the brand new top value TWOSOME for general office, store or school lighting. Ask the man from Smithcraft to show you Smithcraft's "4 GOOD NEW IDEAS IN LIGHTING".

Wherever good lighting is important, you'll find . . .

Smithcraft — "AMERICA'S FINEST FLUORESCENT LIGHTING"
CHELSEA 50, MASSACHUSETTS

PLEASE ATTACH TO YOUR BUSINESS LETTERHEAD and mail to

Smithcraft LIGHTING, CHELSEA 50, MASS.

NAME _____

TITLE _____ CO. _____

ADDRESS _____ CITY _____ STATE _____

☐ Please send me the monthly publication, "Light Side of the News", so that I can keep in touch with the latest trends in lighting.

☐ Please send me folders and catalog sheets on the "4 Good New Ideas in Lighting"

☐ Please send me the complete SMITHCRAFT CATALOG, containing data on America's Finest Fluorescent Equipment.

IE 31

Uni-Race, which houses branch circuit wires, assembled and wired on the floor. 1

Light, rigid Uni-Race assembly, up to 24' long, is easily lifted and hung. 2

Fixtures simply snap into place. The plug in the fixture engages receptacle in Uni-Race. 3

3 easy steps to better lighting

only the Gibson Ortho offers these advantages

SPEEDY INSTALLATION. Contractors throughout the country report that a complete Gibson installation takes, on the average, only 22 man-minutes per fixture, including all wiring, stems, lamping and mounting — a mere fraction of the time required by conventional installations.

AUTOMATIC ALIGNMENT. Rigidity of Uni-Race holds fixtures in precise alignment.

COMPLETE FLEXIBILITY. Ortho fixtures can be mounted in continuous rows or at intervals of 4, 8, 12 or more feet. Spacing can be rearranged at any time without tools. Two-light fixtures can be replaced by four-light fixtures and vice versa.

NO ON-JOB-FIXTURE STORAGE. Fixtures need not be delivered until premises are painted. They are then snapped into place on the pre-hung Uni-Race, clean and factory-fresh.

NO WELDED JOINTS. The Ortho 77 is the finest fixture money can buy. One reason is that all adjoining parts are interlocked by screws, rods or tabs. No welded parts to come loose.

ortho-77

Patent Pending

There are many more features you should know about. Write today for full particulars on the Ortho 77.

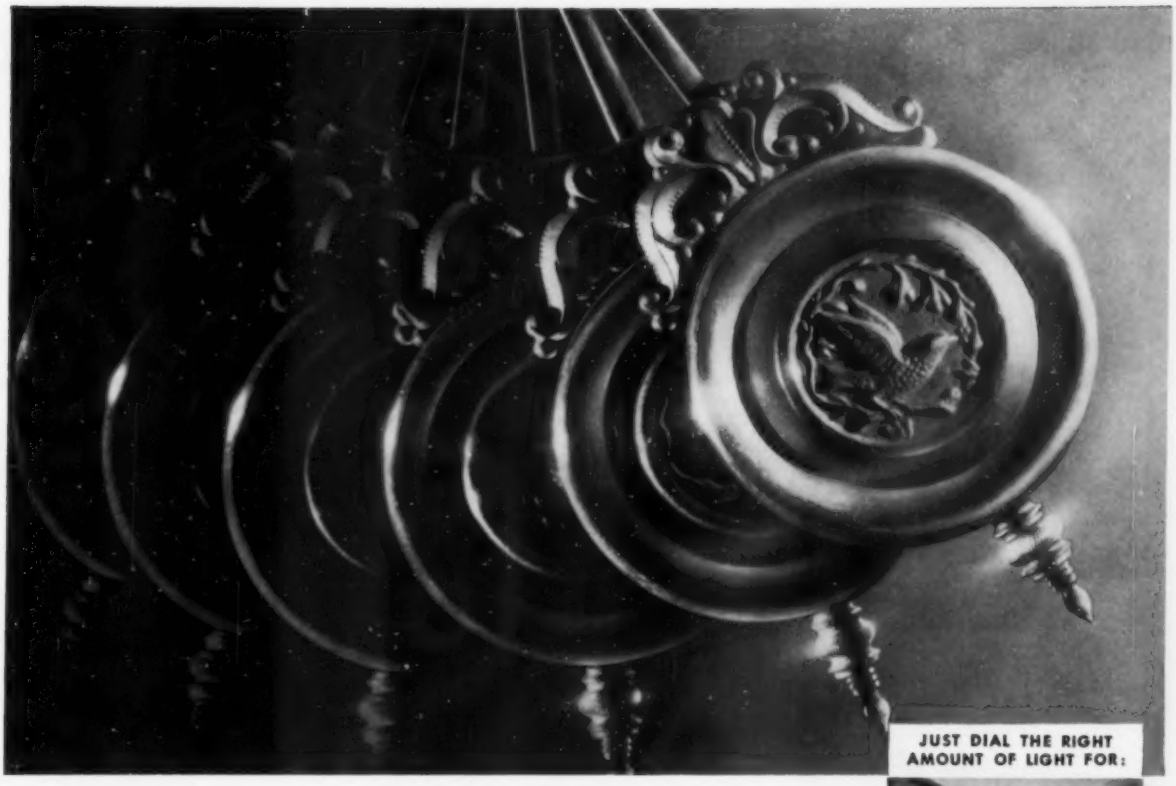
Gibson LIGHTING

GIBSON Manufacturing Co.

1919 Piedmont Circle, N.E., Atlanta 9, Georgia

MAKERS OF THE NEW Ceilo • 35 WORLD'S THINNEST FIXTURE WITH NO DARK AREAS

IN CANADA manufactured under franchise by one of Canada's oldest and largest manufacturers of lighting fixtures ELECTROLIER MFG. CO. Ltd., Montreal



JUST DIAL THE RIGHT AMOUNT OF LIGHT FOR:

LUNCH, COCKTAILS, DINNER

THE TYPE OF MEETING

THE TIME OF DAY

LUXTROL Light Control Provides Interiors with the Dimension of **TIME**

No longer do you have to think in terms of static interiors. Hour by hour you can now vary the emotional stimulus of your decor. You can set the mood you want *at the time you want it* throughout the day or night with "all level" lighting. You can add the dimension of TIME to your interior design.

For restaurants this means you can have customers linger and spend more . . . or hurry and make way for others. For stores it means the exact light level for each individual window or display. For offices it sets the mood of the meeting . . . provides proper light contrast with outside light levels. For churches and funeral homes it becomes a part of the service. Just to mention a few.

LUXTROL light control equipment can be used on incandescent, fluorescent and cold cathode lamps. In the complete line you will find units to meet all requirements from 360 to 30,000 watt loads. Send coupon for more information.

LUXTROL

Light Control Equipment

Non-Interlocking Types When only a few circuits require control. Capacities from 1000 to 30,000 watts.

Packaged Types 6000 to 15,000 watt ratings. Circuits can be interlocked. Professional light control at budget prices.

Interlocking Types Single units in 2500 and 6000 watt ratings for mounting in switchboard assemblies.

Type WSD 360 A compact unit designed to replace the ordinary "on-off" switch in a wall. 360 watt rating.

Magnetic Amplifier Systems No moving parts or electronic tubes. Available in 3000, 6000 and 15,000 watt ratings.

a precision product of

THE SUPERIOR ELECTRIC COMPANY

708 ROGER ROAD, BRISTOL, CONNECTICUT

Name_____

Company_____

Street_____

City_____ Zone____ State_____

impossible?

to light a wall
or a drapery, a
bulletin board
or a mural—and
to light it evenly,
without spots or
scallops or streaks—
and from a scarcely
noticeable source . . .
just specify our
#985. It's that easy!

CENTURY
LIGHTING, INC.

521 WEST 43rd ST.
NEW YORK 36, N. Y.
1820-40 BERKELEY ST.
SANTA MONICA, CALIF.
1477 N.E. 129th ST.
N. MIAMI, FLORIDA

(*Continued from page* 37A)

attended the International Electrotechnical Commission general meeting in Moscow as the United States delegate representing the lamp, ballast and associated devices industries. Mr. Lowell also visited lamp manufacturing installations in Sweden, Norway, Denmark, Holland, Belgium, France, Ireland and England during his European tour.

Two appointments have been announced in the marketing organization of General Electric's Large Lamp Department. **James C. Forbes** has been named to the newly-created post of Manager, Residential Sales. **Robert L. Oetting** has been named manager of the department's Southwestern Sales District with headquarters in Dallas, Texas. He succeeds **Ralph A. Nungesser,** who retired from the company on August 1.

Walter C. Granville, formerly assistant director, department of design, Container Corp. of America, and co-author of the Color Harmony Manual, announces the establishment of an independent practice as color consultant. Mr. Granville, whose offices are at 1337 West Fargo Ave., Chicago 26, Ill., will specialize in general color problems, and consult on architectural color plans, coordinated color lines for products and the usage of color systems.

The Consolidated Edison Co. of New York has announced the election of **C. Wesley Meytrott** as vice-president in charge of sales. He succeeds **Otto W. Manz, Jr.,** who was elected executive vice-president of the company.

Duncan M. Jones, I.E.S. Past President, has moved to the Toronto offices of Curtis Lighting of Canada Ltd., where he is Market Planning Manager. Mr. Jones was formerly in Montreal.

The appointment of **Gordon W. Howson** as sales manager of the Westinghouse large lamp department has been announced. Mr. Howson will make his office in Bloomfield, New Jersey. **Robert M. Harris** has been named sales manager of the company's miniature lamp department, and also will be located in Bloomfield.

Succeeding Mr. Howson is **John H. Max** who has been appointed Atlantic region sales manager for the Westinghouse Lamp Division. His headquarters are at 3001 Walnut St., Philadelphia.

Paul Cornelisen has been appointed Sales Manager of the Kirlin Co., Detroit, Mich. Previous to this appointment, Mr. Cornelisen had been with Curtis Lighting for more than 30 years.

Joseph H. Williams has been named Advertising and Sales Promotion Director of the Benjamin Electric Mfg. Co., Des Plaines, Ill. Mr. Williams was formerly General Advertising Manager of the Sangamo Electric Co., Springfield, Ill.

George F. Herold has been re-elected Secretary-Treasurer of the Joint Council of the Associated Engineering Societies of St. Louis. Mr. Herold is a past-chairman of the St. Louis Section, I.E.S.

Henry Gluck has been appointed National Sales Manager of Sunbeam Lighting Co., Los Angeles. Mr. Gluck will coordinate sales and distribution activities both at the west coast headquarters and at the new Gary, Ind., facilities, which is designated Sunbeam Lighting Co., Inc., Eastern.

Louis O'Sullivan, assistant general mannger of Quebec Hydro-Electric Commission, has been named a commissioner of the Crown corporation. At the same time, announcement has been made of the appointment of **Leo Roy** as general manager of Quebec Hydro. Mr. Roy has been chief engineer of the commission's auxiliary services since 1952.

Six new representatives have been appointed by Metalcraft Products Co., Inc., of Philadelphia. These are: Western Pennsylvania and West Virginia, **Robert J. Daum,** 3359 Crestview Drive, Bridgeville, Pa.; Illinois and Indiana, **R. H. Soukup,** 1314 Builders Bldg., Chicago, Ill.; West Coast, **R. E. Baum,** 1085 Monadnock Bldg., San Francisco, Calif.; Western New York, **Paul E. Bowers,** 99 Crestwood Ave., Buffalo, N. Y.; Eastern New York, **J. W. Surtees,** 129 Dewitt St., Syracuse, N. Y.; Minnesota, Wisconsin, Nebraska, North and South Dakota, **Merrill Pearson** has joined **Russell Gerde,** 5649 Grand Ave., South Minneapolis, Minn.

The Edwin F. Guth Co. has appointed Lighting Associates, Limited, 2203 Beaconsfield Ave., N.D.G., Montreal, Que., as their new Canadian representatives. **Omer Trudel** is president of the company and **Malcolm H. Blakely** is vice-president.

Paul J. O'Connell, formerly of Kempner & O'Connell Associates, announces the formation of O'Connell & Associates, manufacturers representatives in the custom field of injection, compression, extrusion and sheet forming. Offices are at 2514 West Peterson Ave., Chicago.

Dr. Thomas Harrison Davies has been appointed Director of Research of the

(*Continued on page* 48A)

EASY AS π!

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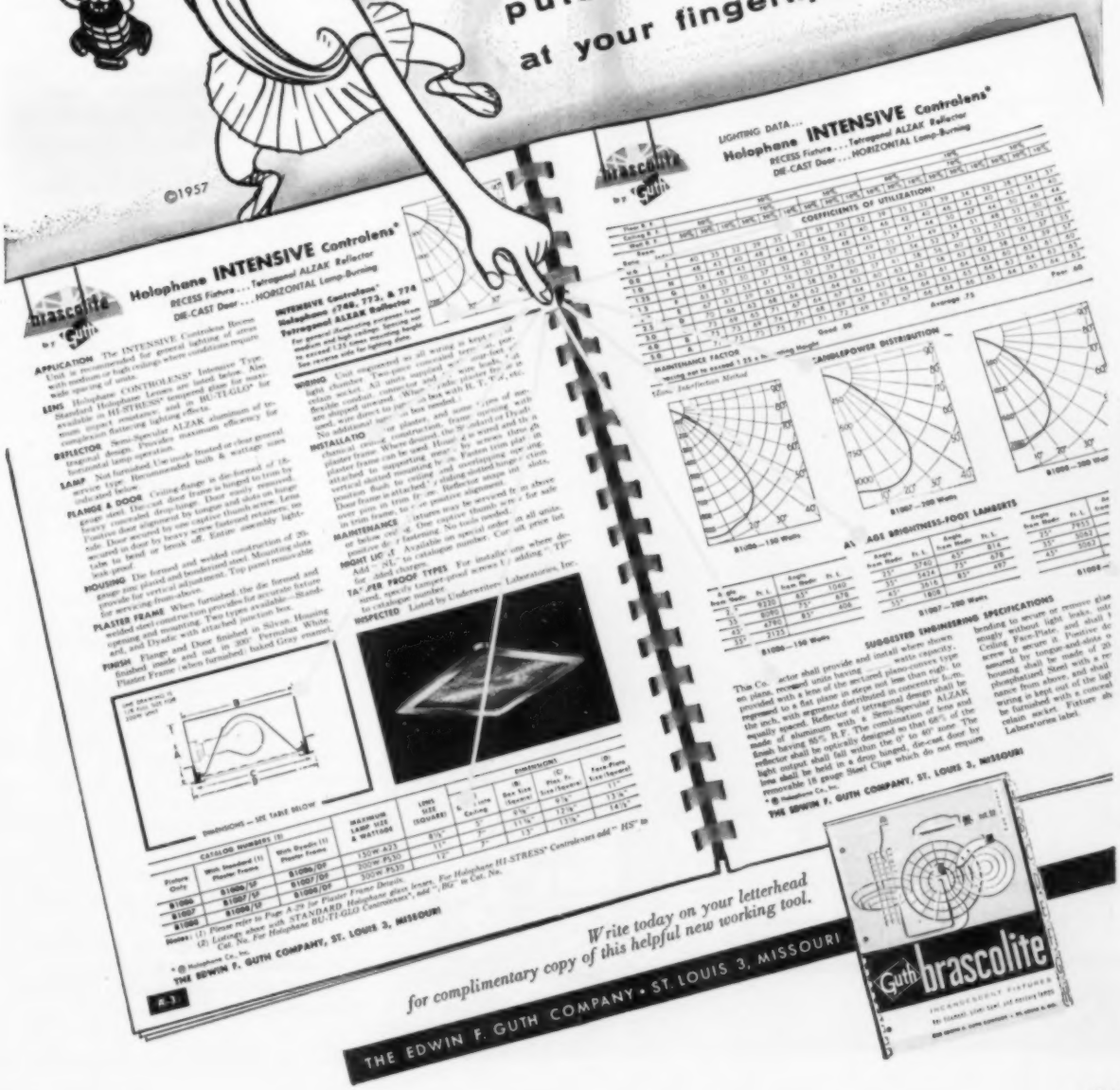
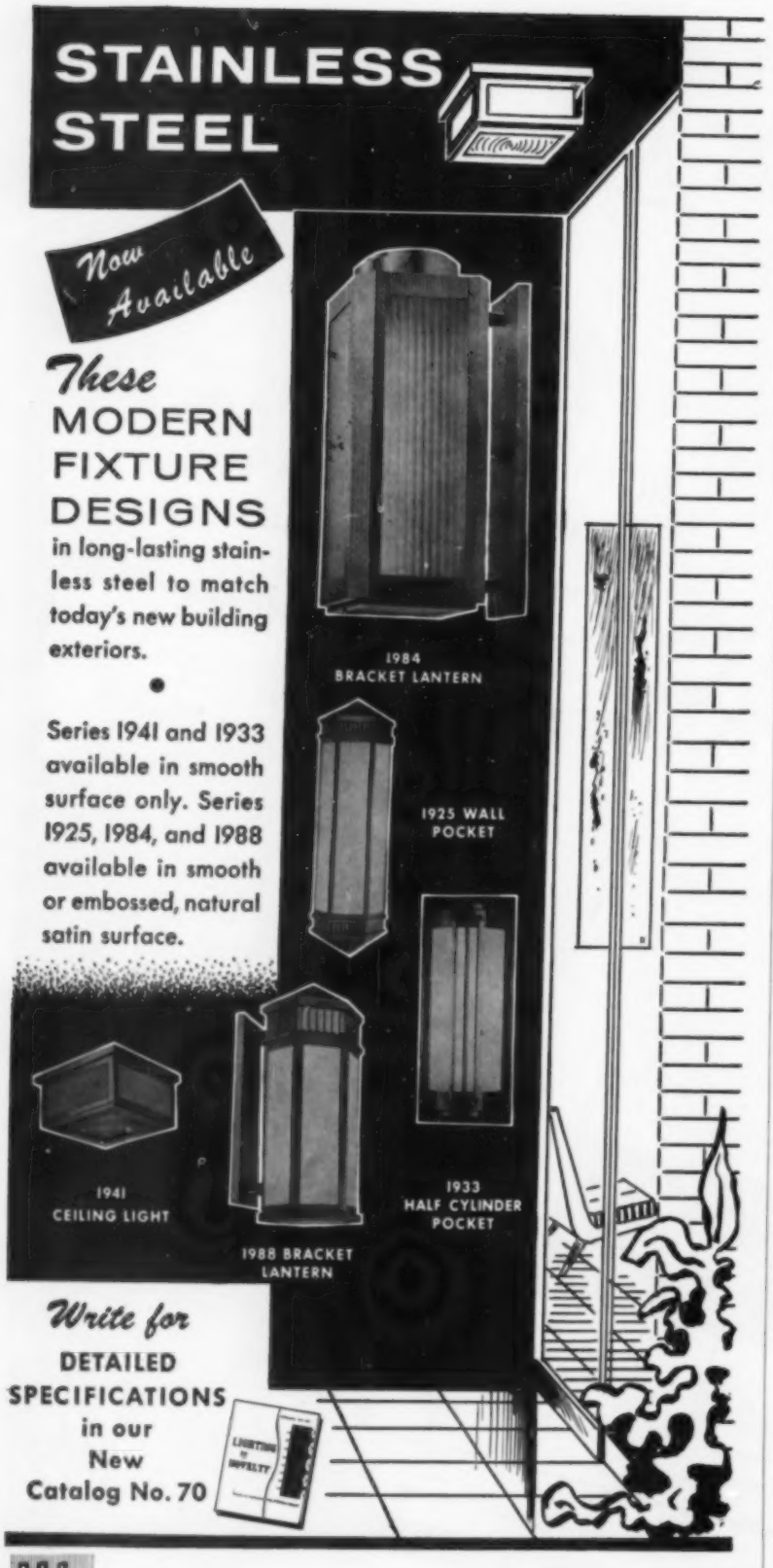
NEW Guth brascolite
INCANDESCENT LIGHTING CATALOG
puts EVERYTHING
at your fingertips...




STAINLESS STEEL
Now Available
These MODERN FIXTURE DESIGNS
in long-lasting stainless steel to match today's new building exteriors.
Series 1941 and 1933 available in smooth surface only. Series 1925, 1984, and 1988 available in smooth or embossed, natural satin surface.
1984 BRACKET LANTERN
1925 WALL POCKET
1941 CEILING LIGHT
1988 BRACKET LANTERN
1933 HALF CYLINDER POCKET
Write for DETAILED SPECIFICATIONS in our New Catalog No. 70
LIGHTING BY NOVELTY
NL Corporation
formerly The Novelty Lighting Corp.
2490 East 22nd Street
Cleveland 15, Ohio

(*Continued from page* 46A)

Mellon Institute, where he has been the administrative head of the Multiple Fellowship sustained in the Institute since 1952 by the Pittsburgh Plate Glass Co.

Westinghouse Lamp Division has named **James J. McAlister** as manager of the Detroit sales district. Mr. McAlister was previously assistant to the region manager in Pittsburgh.

Howard J. Coffey has been appointed supervisor of marine and emergency lighting markets for Exide Industrial Division of the Electric Storage Battery Co., Philadelphia. Mr. Coffey was formerly a district sales representative in Cleveland and Detroit.

Moe Light has announced the promotion of two sales representatives: **John Norbert** has been promoted to Sales Manager of the Midwestern Division and **Charles Cockrill** to the position of Sales Manager of the Southeastern Division. Mr. Norbert has headquarters in Kansas City and Mr. Cockrill in Atlanta.

Leo A. Hansen, Jr., has been named assistant to the sales manager of the Pacific Coast region of Westinghouse Lamp Division. His new office is located at regional headquarters in Emeryville, Calif.

Ruby-Philite Corp. has appointed **Fred C. Olsen** as sales representative for the State of New York, with the exception of Metropolitan New York and Long Island. Mr. Olsen's offices are at 226 Glen Ave., Port Chester, N. Y. Ruby-Philite has also named **Phil Libby,** an associate of H. R. Onarecker and Co., as sales representative in eastern Texas, Louisiana, Mississippi, and Mobile, Ala.

J. W. Devereaux, formerly of Chicago, has set up in business at 222 Snell Isle Blvd., St. Petersburg, Fla., as distributor of lighting fixtures and lamps.

Prescolite Manufacturing Corp., Berkeley, Calif., has appointed **William A. Llewellyn** as sales representative in the Southern California area. He has headquarters in the company's Los Angeles office.

Sven O. Osthagen, of Providence, R. I., has been appointed a vice-president of the American Institute of Electrical Engineers representing a newly-created North Eastern District. Mr. Osthagen is manager of the Providence office of Allis-Chalmers Mfg. Co.

Gerald S. Colvin has been named Sales

Engineer for Leadlight Fixture Co. His headquarters will be in the home office in Oakland, Calif.

William A. Foley, Kansas City, Missouri has been appointed sales representative for Market Electric Products Inc., and LaSalle Products Inc. Sales representative for these companies in Lincoln, Nebraska will be **Ed T. Taber.**

BOOKS AND PAMPHLETS

*Books whose reviews are marked * are available for inspection at the Headquarters Office, Technical Department.*

***A History of Luminescence,** by E. Newton Harvey. Published by the American Philosophical Society (as Volume 44 of the Memoirs), Independence Square, Philadelphia, Pa., 692 pages, 50 pages illustrated, indexed. $6.00.

The purpose of this book is to trace the discovery and ideas relating to all phases of luminescence from antiquity up through the end of the nineteenth century. The historian of science should find a wealth of information on theories of light and luminescence through the author's use of quotations from works of lesser known as well as famous men in science. It is meant to be of value to the physicist, the chemist, the biologist and the illuminating engineer.

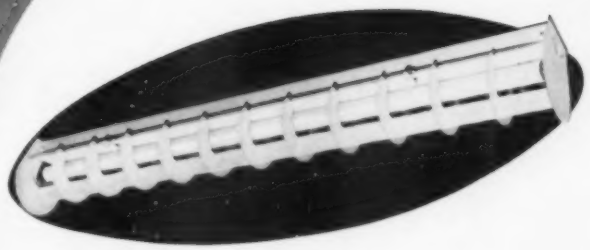
This history is divided into three parts. Part I, "Luminescence through the Centuries," presents a general survey of the knowledge of luminescence from Far Eastern and Classical Antiquity up through the 19th century. Part II, "Luminescence of Non-Living Material," deals independently with specific type of luminescence such as: Electroluminescence; Phosphorescence; Thermoluminescence, Piezoluminescence, Crystalloluminescence and Lyoluminescence; Fluorescence; Radioluminescence; and Chemiluminescence. Part III, "Luminescence of Living Organisms. Bioluminescence," deals with: shining fish, flesh and wood; phosphorescence of the sea; and animal luminescence.

There is a 69-page bibliography containing articles or books written between 1555 and 1900 in which there are sections devoted to the knowledge of luminescences of various kinds.

The author has just retired as Henry Fairfield Osborn Professor of Biology at Princeton University. He has spent nearly 45 years in study of light production

(Continued on page 50A)

L&P Fluorescent Fixtures



THE LOUVERED FALCON

The light you've been looking for—for stairways, corridors, bin lighting, etc. Efficient and economical, the Falcon is built for eye-comfort. Also available plastic enclosed. Write today for prices.

In the Spotlight
FOR AUGUST

This L & P fixture is only one of Light & Power's complete line of fluorescent fixtures—with fine material, expert craftsmanship and quality control built into every unit. The result? Dependability, beauty and efficiency . . . every time!

LIGHT & POWER UTILITIES CORP.

Distributed by Electrical Wholesalers Only

Write or wire today for catalog and prices.

LIGHT & POWER UTILITIES CORP.
1035 Firestone Blvd., Memphis, Tenn.

This...

instead of this

High bay lighting with Abolite is easier on the eyes

• In high bay lighting, Abolite open-top units eliminate uncomfortable contrast of bright lamps against dark background. 18% of the light is directed upward through Abolite's open top, washes out the deep shadows, gives lamps a soft background. 35° shielding of the lamp practically eliminates glare.

Open-top design also gives Abolite high bay units a self-cleaning action. Air circulates through the fixture, sweeps the reflecting surface clean, reduces lamp operating temperatures. As a result, lighting efficiency remains high, lamps last longer.

There are three Abolite uplight units for high bay lighting: 18" and 24" diameter Alzak fixtures for use with 400 and 1000 watt mercury lamps and 18" Alzak fixtures for 500 watt incandescent lamps (ideal for gymnasium lighting). For full details, write Abolite Lighting Division, The Jones Metal Products Co., West Lafayette, Ohio.

ABOLITE *Lighting*

(Continued from page 49A)

by luminous organisms and has published three previous books on the subject — *The Nature of Animal Light* (1920), *Living Light* (1940), and *Bioluminescence* (1950).

ASTM Proceedings, 1956 edition, published by the American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa. 1510 pages. $12.

As described by the title, this book is a record of the accomplishments of the ASTM for last year. It includes technical reports and papers with discussions.

Standard Samples and Reference Standards, issued by the National Bureau of Standards, NBS Circular 552 (second edition), 24 pages, 25c. Order from the Superintendent of Documents, Government Printing Office, Washington 25, D. C. Also available without charge to prospective purchasers of Standard Samples, upon request to the National Bureau of Standards.

This circular contains an up-to-date descriptive listing of the various Standard Samples issued by NBS and supersedes Circular 552 issued in August 1954.

Foreign remittances must be in United States exchange and should include an additional one-fourth of the publication price to cover mailing.

Highway Lighting, Technical Bulletin No. 222, published by American Road Builders' Association, World Center Bldg., Washington 6, D. C. 12 pages, paper-bound. 50c.

Contents of this booklet, which refers for recommendations to the "American Standard Practice for Street and Highway Lighting," cover Specific Elements Requiring Consideration for Highway Illumination, Design Criteria, Adaptation Lighting, and a listing of locations with statistics on traffic deaths at night before and after re-lighting.

NEW MEMBERS

At the meeting of the I.E.S. Council Executive Committee, held at Madison, Conn. on July 12, 1957, the following were elected to membership. Names marked * are transfers from Associate Member Grade.

ALAMO SECTION

Member:

Moore, O. M., Central Power & Light Co., Corpus Christi, Texas.

Associate Member:

Gruver, E. E., Westinghouse Electric Supply Co., San Antonio, Texas.

ARIZONA SECTION

Associate Members:

Alessi, J. J., Arizona Public Service Co., Wickenburg, Ariz.
Ethington, B. W., Bc's Electric, Tucson, Ariz.
Perram, W. G., Jr., Arizona Public Service Co., Phoenix, Ariz.
Reece, F. W., Hughes Aircraft Co., Tucson, Ariz.

ARKANSAS CHAPTER

Associate Member:

Cooper, M. L., A & J Electric Co., Little Rock, Ark.

CAPITAL SECTION

Member:

Harvie, J. B., Jr., Shirlington Trust Bldg., Arlington, Va.

Associate Member:

Parks, P. W., Appalachian Electric Power Co., Bluefield, W. Va.

CENTRAL ILLINOIS CHAPTER

Member:

*Carter, C. E., Associated Engineers, Peoria, Ill.

CENTRAL NEW YORK SECTION

Associate Member:

Dulude, Richard, Corning Glass Works, Corning, N. Y.

CHICAGO SECTION

Member:

*Hamilton, J. C., Advance Transformer Co., Chicago, Ill.

Associate Members:

Moran, L. L., Outdoor Advertising Assoc. of America, Chicago, Ill.
Van Ness, C. E., Van Ness Electric Co., Valparaiso, Ind.

CLEVELAND SECTION

Member:

Jira, J. C., National Advisory Committee for Aeronautics, Lewis Flight Propulsion Lab., Cleveland, Ohio.

Associate Member:

Gillem, W. R., McGeorge Hargett & Associates, Cleveland, Ohio.

COASTAL EMPIRE CHAPTER

Member:

Johnson, D. W., Johnson Lighting Fixture Co., Savannah, Ga.

Associate Members:

Fields, J. G., Graybar Electric Co. Inc., Savannah, Ga.
Helfrich, C. E., Helfrich & Grantham, Savannah, Ga.
Kelley, W. C., Morris Electric, Savannah, Ga.
Peters, R. W., General Electric Supply Co., Savannah, Ga.

CONNECTICUT SECTION

Members:

Paul, C. E., Jr., Starring & Co. Inc., Bridgeport, Conn.
Heinze, G. M. N. Y., N. H. & H. Railroad, New Haven, Conn.

EDMONTON CHAPTER

Members:

Neilsen, A. J., Commercial Electric (Edmonton) Ltd., Edmonton, Alta.
McBride, J. M., Industrial Power Installations Ltd., Edmonton, Alta.
Sunley, E. S., Sunley Electric, Edmonton, Alta.

Associate Members:

Addison, H. P. F., Northern Electric Co. Ltd., Edmonton, Alta.
Bailey, W., Canadian Westinghouse Supply Co. Ltd., Edmonton, Alta.
Bone, J. N., W. Freeman & Son Ltd., Edmonton, Alta.
Bradshaw, J. B., Northern Electric Co., Edmonton, Alta.
Bromley, A. H., Jasper Place Electric Ltd., Edmonton, Alta.
Cote, J. F., The Birmingham Electric, Edmonton, Alta.

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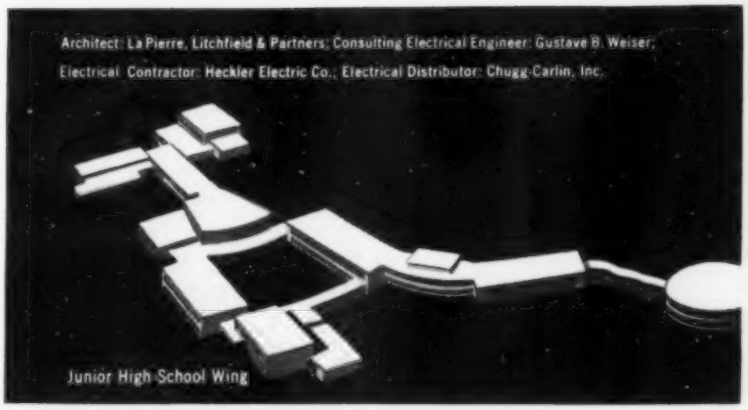
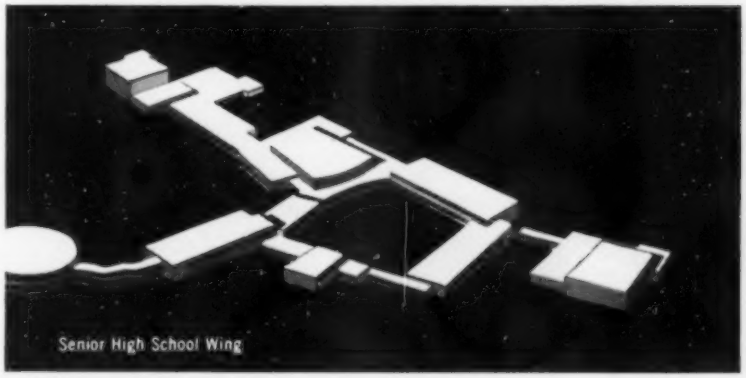

Architect: La Pierre, Litchfield & Partners; Consulting Electrical Engineer: Gustave B. Weiser;
Electrical Contractor: Heckler Electric Co.; Electrical Distributor: Chugg-Carlin, Inc.
Junior High School Wing

lighting design by **mc Philben**

for the magnificent new Great Neck High School

...a wholly new concept in school architecture and quality building.



McPhilben 43-24 recessed weather-tight downlights will light the exterior corridors of this superb new school in Great Neck, N. Y. Only 3½ inches deep, the 43-24 housings are sturdily constructed of 16 gauge galvanized steel. The gleaming satin finish of the face plates will resist all corrosive elements, thanks to the anodized cast aluminum construction. And, mcPhilben's exclusive Sealume gasket of neoprene rubber will assure permanent weather-tight maintenance-free operation.
Your mcPhilben representative has full details about the 43-24 and other mcPhilben recessed weather-tight downlights, both square and round. Contact him or write to mcPhilben Lighting Co., 1333 Willoughby Avenue, Brooklyn 37, N. Y.

Representatives in major cities • Stocked by electrical wholesalers

Employment Opportunities

LIGHTING SALES REPRESENTATIVE
Large nationally-known manufacturer of commercial incandescent, fluorescent lighting fixtures and louvred ceilings, Holophane Licensees. Knowledge lighting application, experienced with architects and engineers. Territory Maryland, D.C., Delaware and Pennsylvania. Commission basis. Address Box 312, Publications Office, Illuminating Engineering Society, 1860 Broadway, New York 23, N. Y.

SALES OPPORTUNITY WANTED
I.E.S. member and college graduate, in the field for seven years, last five years as lighting specialist for large independent North Jersey distributor, desires position with manufacturer or manufacturer's representative. Now doing layouts with architects and contractors. Young (29), married, two children. Good appearance, responsible, ambitious. Address Box 315, Publications Office, Illuminating Engineering Society, 1860 Broadway, New York 23, N. Y.

LIGHTING MANUFACTURERS REPRESENTATIVE

Wanted for North and South Carolina. An exceptional opportunity for an experienced lighting salesman to represent a national company now being specified and displayed in this active territory.

We manufacture a full line of incandescent and fluorescent fixtures, provide good service, rapid delivery and strong promotional backing. The man looking for a better than average income will find here the chance to make ability, experience and drive pay off in a big way. Send full details to Litecraft Manufacturing Corp., 8 E. 36th St., New York 16, N. Y.

REPRESENTATIVE WANTED

Specific territory open. Sales representative or sales organization wanted to contact architects, engineers, contractors and electrical distributors to sell nationally known commercial, industrial and institutional lighting line, meeting today's competition and tomorrow's future design. We are Holophane licensees and members of the RLM Standards Institute. Due to our new accelerated sales program, many new territories are open (protected). We have just completed our 1957 catalogue which is ready for national mailing. Kindly contact Box 277 Publications Office, Illuminating Engineering Society, 1860 Broadway, New York 23, N. Y

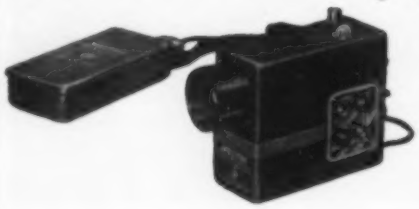
LIGHTING ENGINEERS

Westinghouse leadership in a rapidly expanding lighting industry creates a real need for experienced sales engineers. Prefer men who can be ready for assignment in one of our key field offices after a brief indoctrination at Cleveland. Position involves an interesting combination of creative sales engineering, sales promotion and administrative work. Excellent opportunities for advancement. Send resumes to Westinghouse Electric Corp., Lighting Division, 1216 W. 58th St., Cleveland 1, Ohio. Attention: Sales Manager.

LIGHTING SALES REPRESENTATIVE

To call on architects, engineers, wholesalers, contractors, etc. Complete line of commercial and industrial fluorescent and incandescent lighting equipment sold through electrical wholesalers only. Progressive sales and advertising policy; commission basis. Ohio, North Carolina, South Carolina, Georgia and Florida now open. Furnish complete resume including lines now carried. Address Box 316, Publications Office, Illuminating Engineering Society, 1860 Broadway, New York 23, N. Y.

SPECTRA® BRIGHTNESS SPOT METER



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Special Features of Standard Model:

Extreme Sensitivity Range
Direct Reading in ft-L
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Other Models Available For Greater Sensitivity

DIRECT READING! All operators will obtain the same reading of the brightness of a given area.

Special Computer for exposure determination also available.

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HOLLYWOOD 38, CALIF.

(Continued from page 51A)

Creighton, A. G., Canadian Westinghouse Co. Ltd., Edmonton, Alta.
Eberly, D. L., Sunley Electric Ltd., Edmonton, Alta.
Fisher, L. S., Paramount Electric (Alberta) Ltd., Edmonton, Alta.
Garritsen, H. R. A., Carl Tomlinson Electric Ltd., Edmonton, Alta.
Hammond, G. F., Hammond Electric Ltd., Edmonton, Alta.

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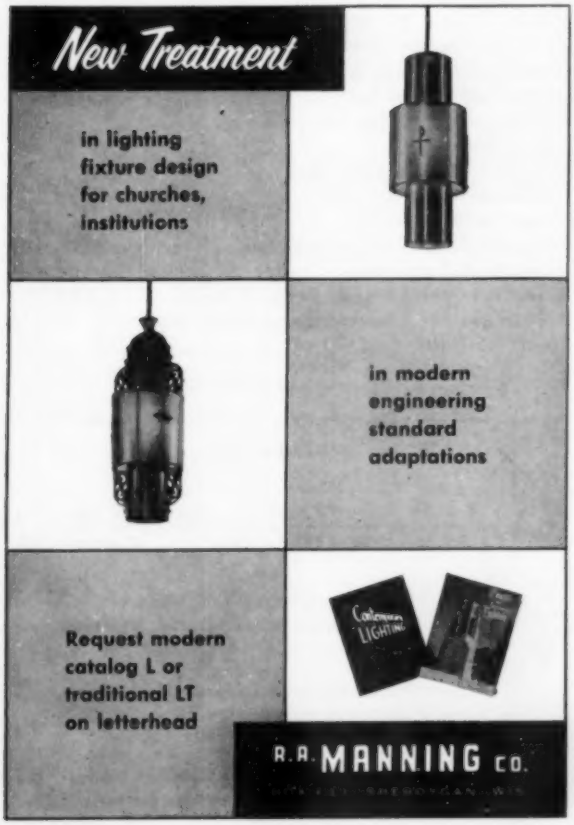
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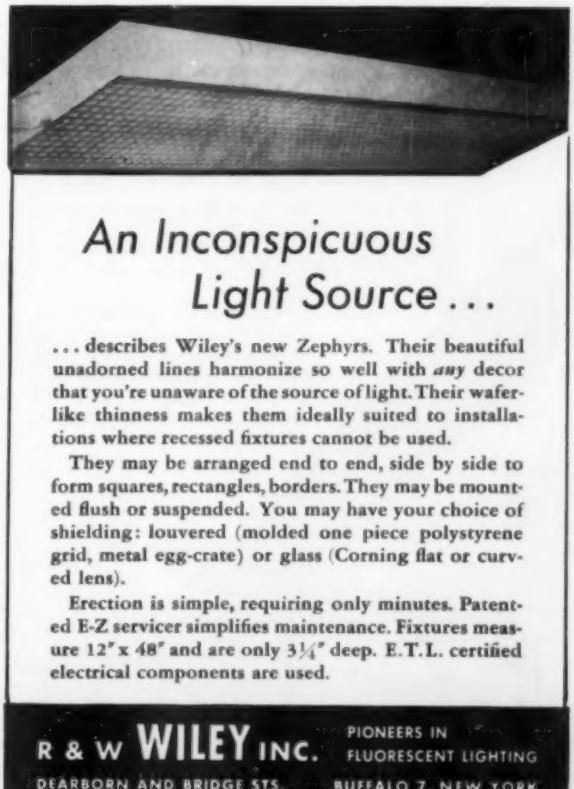
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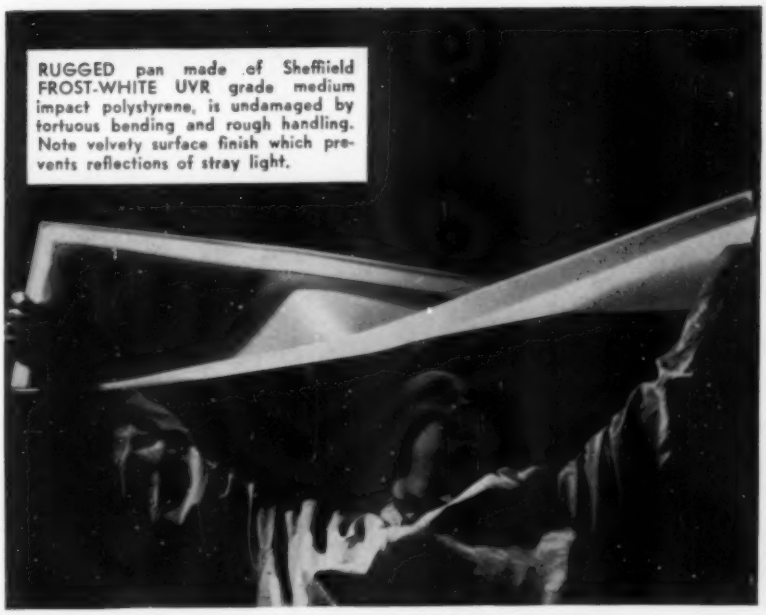
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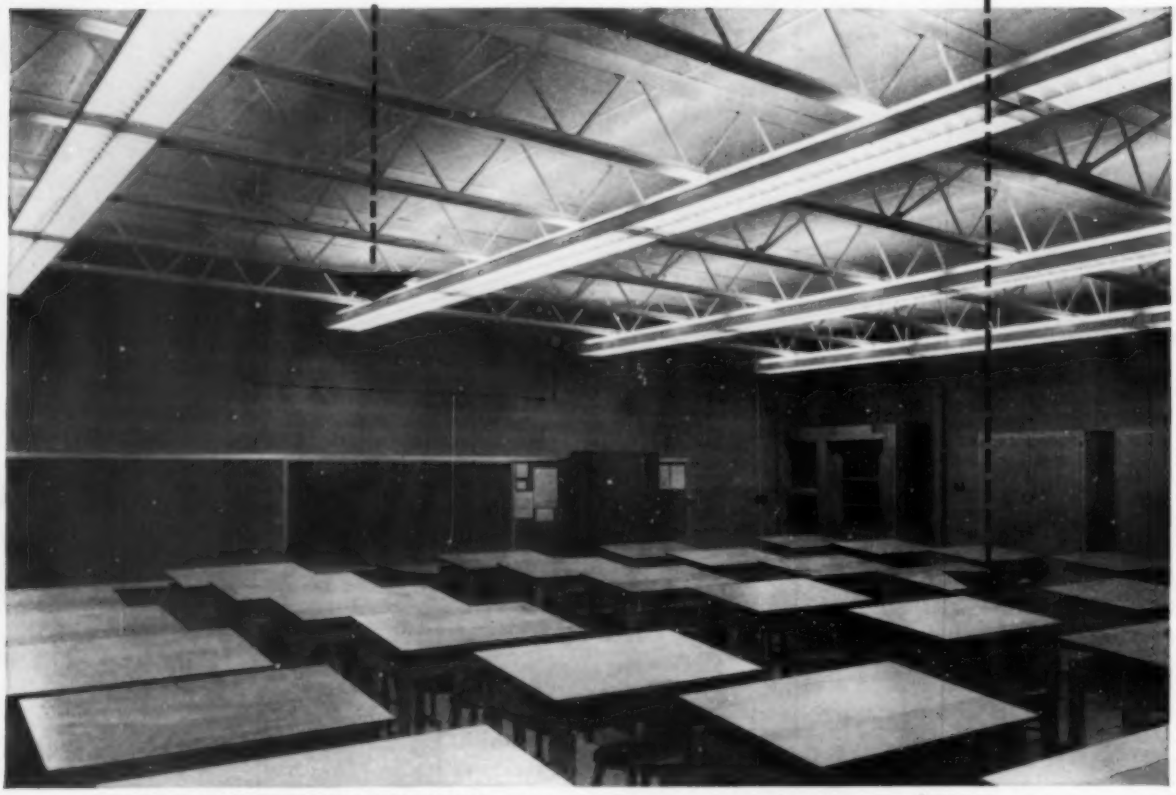

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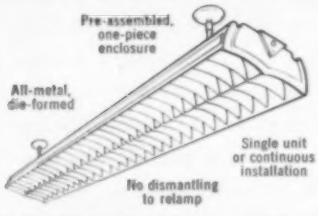

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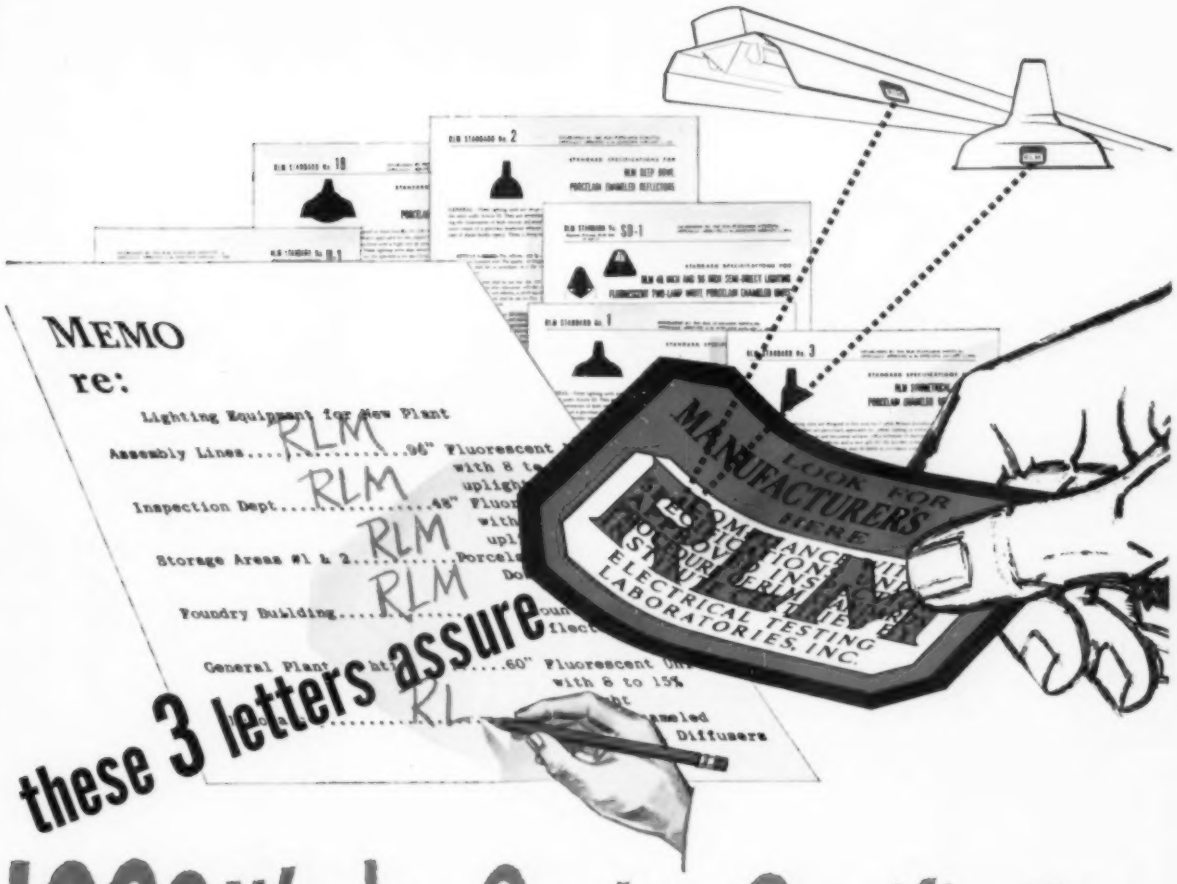

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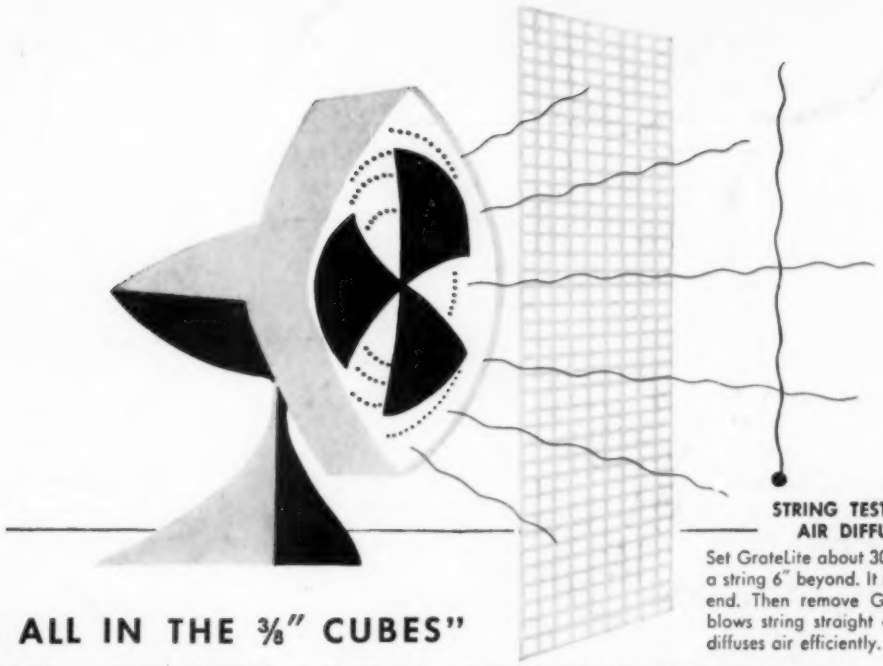

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Set GrateLite about 30" from a fan. Hold a string 6" beyond. It ripples from end to end. Then remove GrateLite—and fan blows string straight outward! GrateLite diffuses air efficiently.

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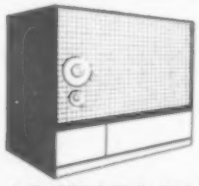

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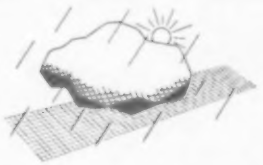

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GrateLite is one solid piece—not just glued-together pieces! It is dimensionally stable, and is unaffected by changes in humidity or by high humidity itself. GrateLite is a solid body!

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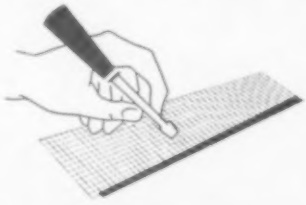
You can step on GrateLite... it won't mar, crumble or crunch. Its solid tapered vanes are Guth-engineered for maximum strength and ruggedness—important in maintenance!

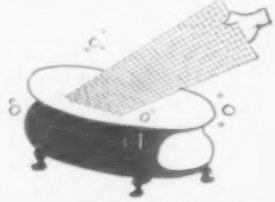
STANDS ROUGH HANDLING!

GrateLite won't bend, buckle or mar when taken down for cleaning and relamping, etc. It won't twist in your hand. Its body and substance are designed for long use.



SCRATCH-RESISTANT!

GrateLite doesn't scar easily—or rip or break when dropped or struck by a tool. Fingernails can't mar its usefulness. No "black eyes," no damaged cubicles to destroy overall beauty and efficiency.



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